AMERICAN
DYESTUFF REPORTER

Devoted to Textile Chemistry
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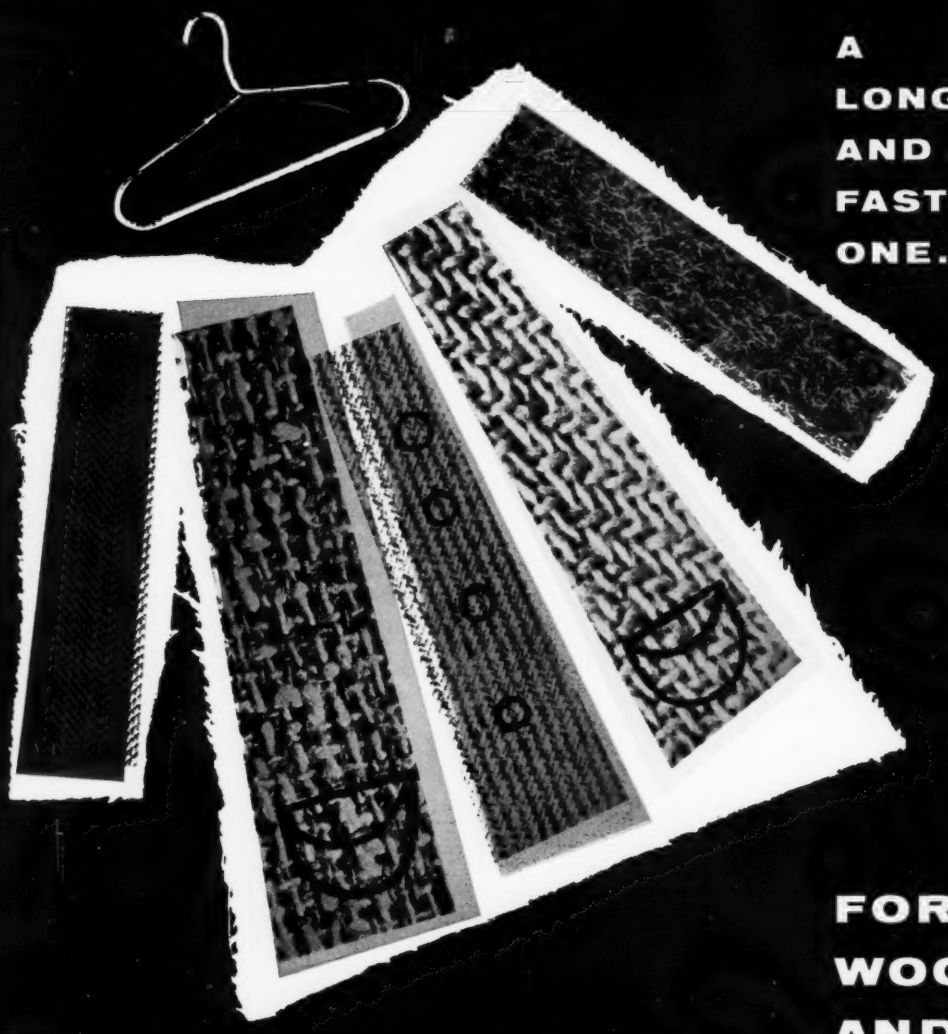

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Proceedings of the

American Association of Textile Chemists and Colorists

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Editor of Proceedings: Carl Z Draves, 30 Lahey St, New Hyde Park, N Y

JULY 5, 1954

Membership Applications

June 11, 1954

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Howard P Brokaw—Supervisor of dyeing & finishing, Textile Fibers Dept, E I du-Pont de Nemours & Co, Inc, Wilmington, Del. Sponsors: G W Richardson, N W Goodell.

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Textile World, New York, N Y.

APPLICATIONS FOR TRANSFER TO SENIOR MEMBERSHIP

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Robert N Armour
Herbert H Bander
Alfred W Cowan
Robert E Sebra

AATCC CALENDAR

COUNCIL
1954—Sept 15, Nov 19.
1955—Jan 21, Apr 15, June 17

NATIONAL CONVENTIONS
Sept 15-18, 1954 (Atlanta Biltmore Atlanta, Ga); Sept 21-23, 1955 (Chalfonte-Haddon Hall, Atlantic City, N J; 1956 (New York); 1957 (Boston).

NORTHERN NEW ENGLAND SECTION
Oct 8 (Colonial C C, Lynnfield, Mass); Dec 10 (Woodland Golf Club, Auburndale, Mass).

PACIFIC NORTHWEST SECTION
July 24 (Outing, Mt Hood Golf Club).

PIEDMONT SECTION
Oct 16 (Hotel Barringer, Charlotte, N C).

PHILADELPHIA SECTION
Sept 24, Oct 29 (Penn-Sherwood Hotel, Philadelphia, Pa); Dec 3 (Kugler's Restaurant, Philadelphia).

RHODE ISLAND SECTION
Oct 14 (Johnson's Hummocks Grille, Providence, R I); Dec 2 (Annual Meeting—Sheraton Biltmore, Providence, R I).

SOUTH CENTRAL SECTION
Dec 4 (Hotel Patten, Chattanooga).

SOUTHEASTERN SECTION
Dec 11 (Atlanta-Biltmore, Atlanta, Ga).

WESTERN NEW ENGLAND SECTION
Oct 1, Nov 12, Dec 10 (Rapp's Restaurant, Shelton, Conn).

(A general calendar of events may be found on page 452)

NOTICE TO SECRETARIES AND PUBLICITY CHAIRMEN OF LOCAL SECTIONS

Papers presented before local sections should be sent to Dr Carl Z Draves, Editor of the *Proceedings*, 30 Lahey Street, New Hyde Park, New York. Authors should provide two copies for this purpose.

Reports of local section meetings should be sent to the American Dyestuff Reporter with copies going to Dr H C Chapin, National Secretary.

Dates of meetings and advance notices of meetings should be sent to the American Dyestuff Reporter with copies also going to Dr Chapin. For publication in any particular issue, information should be in the office of the Reporter 17 days before the issuance date.

EMPLOYMENT REGISTER

This column is open for two insertions per year, per member, without charge. Blanks can be obtained from, and filed with, the Secretary of the Association, Lowell Technological Institute, Lowell, Mass. It is understood that these will be open to inspection by prospective employers who can obtain further information from the Secretary.

54-12

Education: chemistry & dyeing, college evening course.
Experience: laboratory and dyehouse management, development of dyeing processes.
Age: 55; married; references; now operating own laboratory, but desire position in dyestuff application, research or process development, location immaterial.

6-21, 7-5

54-13

Education: high school and correspondence schools.
Experience: foreman and superintendent of finishing.
Age: 49; married; references; northeastern U S preferred.

6-21, 7-5

54-14

Education: B Chem Eng.
Experience: textile chemist and engineer, technical sales service and research.
Age: 37; married; references; New England preferred.

7-5, 7-19

54-15

Education; textile school, evening classes.
Experience: textile mill chemist, woolen and worsted.
Age: 56; married; references; position in eastern U S desired.

7-5, 7-19

54-16

Education: BS, home economics & textile chemistry, graduating 1954.
Experience: playground instructor and clerk during college vacations.
Age: 22; woman; unmarried; references; position as textile chemist desired; location not restricted.

7-5, 7-19

*AATCC Research Newsletter No. 13

NEWS IN GENERAL

On his return June 22nd from ISO meetings in Scarborough, England, chairman of the American delegation Leonard S Little reported that 35 tests for color fastness had been tentatively approved as international standards, and that 3 others are subject to further check. 6 were withdrawn.

In the main, general agreement was reached among the 41 representatives of 13 countries regarding mill process tests, with only a few minor questions still to be worked out. Practical application studies remain to be made on some of the end-use tests that received tentative approval. Some of the lightfastness and shrinkage in laundering procedures that were not approved will be submitted to further study.

TCR chairman Chas W Dorn has again stressed that AATCC never initiates or takes a position with regard to legislation of any kind, though such legislation may involve use of its test procedures. AATCC is concerned solely with the development of tests to serve the needs of industry and others, Mr Dorn pointed out, and does co-operate with legislative efforts when necessary but only to the extent of assuring proper use of its tests.

The 181st meeting of the Technical Committee on Research will be in Atlanta, Ga, on the occasion of AATCC's 1954 convention. Research committee chairmen will be asked in due course to indicate their plans for meetings of their groups at that time.

AT RESEARCH HEADQUARTERS

The parade of Japanese textile representatives through research headquarters continues with the latest contingent including: K Maegawa, chief of the Import Division of Machinery Dept, C Itoh & Co, Ltd, Higashi-Ku Osake; Kindi Akaza; and Kichro Akaza, president of Akaza Textile Industrial Co, Ltd, Kanzawa. Robert J Ross of Dewey & Almy Chemical Co, Cambridge, Mass, accompanied the visitors.

The test methods section of the 1954 Technical Manual and Year Book has been checked and approved for printing, according to a report by Editor Wm H Cady. This, and the correction of galley proofs on membership listings, have cleared the way to an early completion and delivery of this important publication. AATCC staffer Robert Thompson is handling the administrative details.

AATCC research associate Charles Seibert, chairman of the Reference Committee on Colorfastness to Chlorine, has made the required three-year review of Standard Test 3-52 and will shortly submit his recommendations. AATCC laboratories will investigate the effect of doubling the amount of sodium bisulfite called for in the present test before submitting a final report. The added volume of $NaHSO_3$ has been suggested for more efficient removal of chlorine from the sample.

In co-operation with AATCC laboratories the Committee on Abrasion is about ready to launch its study of the use of the Accelerotor for abrasion evaluations. Some thirty fabrics have been assembled including denims, twills, chambrays and shirtings. Some of the fabrics contain nylon, while others are all-rayon constructions.

COMMITTEE ACTIVITIES

A meeting of the Subcommittee on Flammability of Wearing Apparel of the National Fire Protective Association was attended by E P Johnstone of AATCC Research Laboratories and H E Hager (chairman), Charles W Dorn, Cameron A Baker and George S Buck of AATCC's Flammability Committee. The meeting was called to discuss results of interlaboratory studies made at AATCC Research Headquarters, the Fire Protective Division of the National Bureau of Standards, and the laboratory of the California State Fire Marshal on the relation of burning angle and specimen length to the rate of burning. Also reported were the results of investigations of methods to determine "flame intensity." California's Fire Marshal, Joe E Yokers, presented data on other flammability studies he has made.

*Published every other issue of the AMERICAN DYESTUFF REPORTER.

1954 National Convention and "The South's First Textile Wet Processing Exhibit"——

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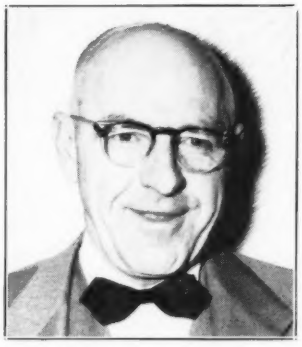

A R Thompson

THE Publicity Committee plans to cover the Convention thoroughly from headquarters at the Atlanta Biltmore Hotel, and it is expected that radio and TV coverage will be quite complete.

Anyone requiring the services of the Publicity Committee is invited to contact any of the following members: A R Thompson, *chairman;* G R Bellamy, Ciba Co, Inc, Chattanooga, Tenn; or Nelson F Getchell, National Cotton Council of America, Washington, D C.

J W Swiney

UNDER the chairmanship of James W Swiney, Fulton Bag & Cotton Mills, the Finance Committee is exerting every effort to insure the financial success of the forthcoming Atlanta Convention so that, when the final tabulations are in, there will be no deficits and all those attending will have had a most enjoyable time at normal expense. Mr Swiney is being assisted by Francis S Webster, F H Ross Co.

It is urged that early registrations and applications for the various banquets and luncheons be made.

Executive Committee—1954 Convention

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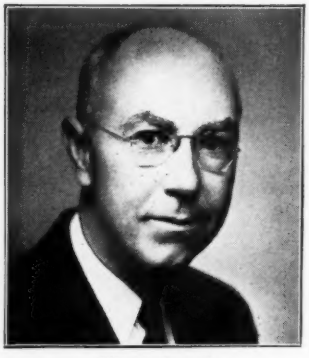
Charlotte, N C

W D APPEL TO BE 11th OLNEY MEDAL RECIPIENT

WILLIAM D APPEL, chief of the Textile Section, National Bureau of Standards, U S Department of Commerce, will receive AATCC's highest award, the Olney Medal, at the Atlanta Convention in September.

Awarded annually for outstanding achievement in the field of textile chemistry, including the development of chemical agents or chemical processes used in the manufacture of textiles or methods for their evaluation, the Olney Medal is endowed by Howes Publishing Co, Inc as a testimonial to the late Louis Atwell Olney, founder of AATCC. Mr Appel will be the 11th recipient of the medal.

William D Appel was born in Washington, D C in 1892. He received a B S degree in chemistry from the University of Chicago in 1917 and an honorary Master of Science degree and professorship from Lowell Technological Institute in 1952. He joined the staff of the National Bureau of Standards in 1922 after five years experience in the dyestuff industry.



W D Appel

He was appointed chief of the Textile Section of the Bureau in 1929. He is the author of numerous technical papers on dyes and textiles.

Mr Appel served as leader of the American delegation to meetings of Technical Committee 38 on Textiles of the International Organization for Standardization in England in 1951 and as a member of the delegation in 1948, 1952, and 1954. He is chairman of American Society for Testing Materials Committee D-13 on Textile Materials, American Standards ISO/TC 38 - Textiles, Federal Specifications Board Technical Committee on Textiles, and a member of Textile Research Advisory Committee. He is a past president of the American Association of Textile Chemists and Colorists (1944-1946) and has been a member of its Technical Committee on Research since 1924. He is a member of the American Chemical Society (chairman, Dye Division 1931-1935), American Association for the Advancement of Science, Society of Dyers and Colourists, The Textile Institute, and the Washington Academy of Sciences.

Mr Appel has received the Silver Beaver Award of the Boy Scouts of America and an Exceptional Service Award of the U S Department of Commerce.

Philadelphia Section Outing Attracts Over 350

EDWARD J SMITH, Philadelphia area representative for Nyanza Color & Chemical Co, turned in a three-over-par 74 on a rain-soaked course to take low-gross honors in golf as the Philadelphia Section met on May 22nd for its annual outing. The annual event, which this year attracted over 350 members and guests, was held at the Manufacturers' Golf and Country Club, Oreland, Pa.

Another highlight of the golfing competition was the hole-in-one competition on the 152-yard fourth which was won by Claude Ruth, W O Leininger Co.

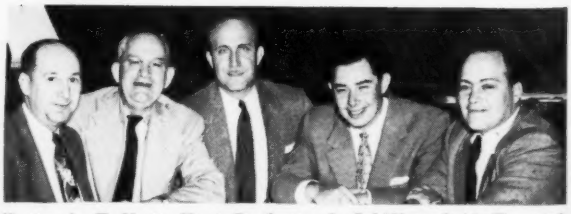
In addition to the golfing competition, the outing included activities in darts, quoits, cards, etc, and wound up with a gala floor show featuring five acts.

During the evening dinner, outing chairman Donald Robinson of Para Chem Inc, extended his thanks to members of the various committees for making the affair an outstanding success.

Clarence A Seibert (right), chairman of the Golf Committee, presents Edward J Smith, Nyanza Color & Chem Co, with cup for low gross in the golf competition.

(L to r) A F Haas, International Processing Co; W Alkus, Richmond Oil, Soap & Chem Co; D Robinson, Para-Chem, Inc.

(L. to r): D Kelleher, J McAlaren and C Leckey, A M Townsen; A Wolf, Thermco Products.



(L to r): T Hart, Hart Products; L Schiff and M Temptal, Thermco Products; I Kreindel, Allen Dyeing Co; M Schiff, Thermco Products.

Philadelphia Section Outing

(L to r): J Rhodes, Am Cyanamid; T R Scanlon, Hart Products; J Farrell, H Warshaw & Sons; N Garrett, John Campbell & Co; J Weierman, Pioneer Chemical; L J Clark, Continental Mills; K Schmalenberger, Geigy Chem Corp.

Winner of the hole-in one contest—Claude I Ruth, W G Leininger.

R Fidler, Kohout & Fidler; J R Bamford, Schuylkill Haven Bleach & Dye Works; G Harkins and C Seal, Amalgamated Chemical; M Bamford, Schuylkill Haven Bleach & Dye Works; J Jester, Amalgamated Chemical; R Kroeuer, Kohout & Fidler.

Ray C Young, Du Pont

L Schiff and M Pemptol, Thermco Products; I Kreindel, Allen Dyeing Co; M Schiff, Thermco Products.

A Boesler, Amalgamated Chemical; W Bertolet, Laurel Soap; N Reinert and J Roth, Emery Industries.

1953 Intersectional Contest——

RELATIONSHIP BETWEEN STRUCTURE OF DYES AND THEIR DYEING CHARACTERISTICS ON HYDROPHOBIC FIBERS*

NORTHERN NEW ENGLAND SECTION

K L Dorman

COMMITTEE

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R Robinson
Bachmann-Uxbridge Worsted Co, Inc

N Reed
Lowell Technological Inst

R Travis
Pepperell Mfg Co

K R Fox

Some of the newer, wholly synthetic fibers have offered difficulties in dyeing. In order to promote the development by dyemakers of new dyestuffs for these fibers, a study of the dyeing behavior of several classes of dyestuffs has been made so that dye affinity could be related to dye constitution. Standardized dyeings were made on Dynel, Dacron, Acrilan, and Orlon with disperse (acetate) dyes, basic dyes, special basic dyes, milling acid dyes, and premetalized dyes in comparison with dyeings on acetate and nylon fibers. From a consideration of the chemical constitutions the following facts and conclusions have been derived: disperse dyes have affinity for all the fibers studied, many of the basic colors had good affinity for only some of the fibers, and the acid dyes for fewer of the fibers. Hydroxyl groups (and perhaps ketonic groups because of tautomerism to hydroxyl) seem to impart affinity; sulfonic and carboxyl groups impair affinity.

INTRODUCTION

THE phenomenal increase in production and use of the man-made fibers, as well as their tremendous customer appeal, has made these chemical fibers an important factor in the textile industry. From a negligible consumption in 1940 (excluding rayon), consumption rose to 3% in 1952, and by 1970 it is estimated that the consumption of synthetics will be between five and eleven per cent of the total. Dollarwise in 1952, the synthetic fibers amounted to 10%. Projecting this twenty years, the value of the synthetics should be approximately 30% of the value of all fibers used. This is shown in Figure 1. On a yardage-production basis of woven fabrics in 1952, man-made synthetics slightly topped the production of woolen and worsted goods. Out of a total production of twelve billion yards, the chemical fibers constituted 380 million yards. This is shown in Figure 2.

Comparative costs of the various fibers are shown in Figure 3. At the present time the cost of the chemical fibers approximates three to five times that of cotton, the cheapest large-usage fiber.

Hand in hand with the increase in consumption of the newer hydrophobic man-made fibers are the difficulties of coloration. Dyers and dye manufacturers have had suddenly thrust upon them application and manufacturing problems which must be solved. A new fiber is of but very limited value unless it can be dyed. Furthermore, it will not suffice to dye the fiber without attaining the proper fastnesses desired and necessary in the end use of the fiber, yarn or fabric.

Considerable effort towards solving the dyeing of the newer hydrophobic chemical fibers has been attacked via the technique of application methods. These include:

A) *Swelling Agents*, e g, the ortho- and paraphenylphenols, benzoic acid, chlorobenzols, and phenylmethylcarbinol. Difficulties with such assistants include cost, removal after use, lightfastness degradation, and toxicity. In general, mills prefer to avoid the employment of "swellers" whenever possible.

B) *Fiber Mordanting*, e g, cuprous ion formed in situ from bluestone and a reducing agent, such as hydroxylammonium sulfate, sodium bisulfite, or sodium hydrosulfite. This technique is employed only with acid dyes. Serious questions have arisen as to the catalytic degradation of certain acrylics, by the cuprous-ion pressure method followed by certain steaming operations in finishing. Another point concerns the dull shades produced by the cuprous-ion method.

C) *Pressure Dyeing at High Temperatures*. This method is difficult to employ with blended fabrics since some of the fibers present may be degraded if not destroyed by this treatment. In addition, many mills are not equipped with pressure equipment and do not wish to increase their capital investment if it can be avoided.

D) *Cross-Bonding Additives to Polymer Mix*. The addition, for example, of methyl methacrylate to the monomer or to the spin solution to produce a more dyeable

* Presented at the Conrad Hilton Hotel, Chicago, Ill, on Sept 19, 1953. Submitted to the Dyestuff Reporter by the Editor of Proceedings on Feb 25, 1954.

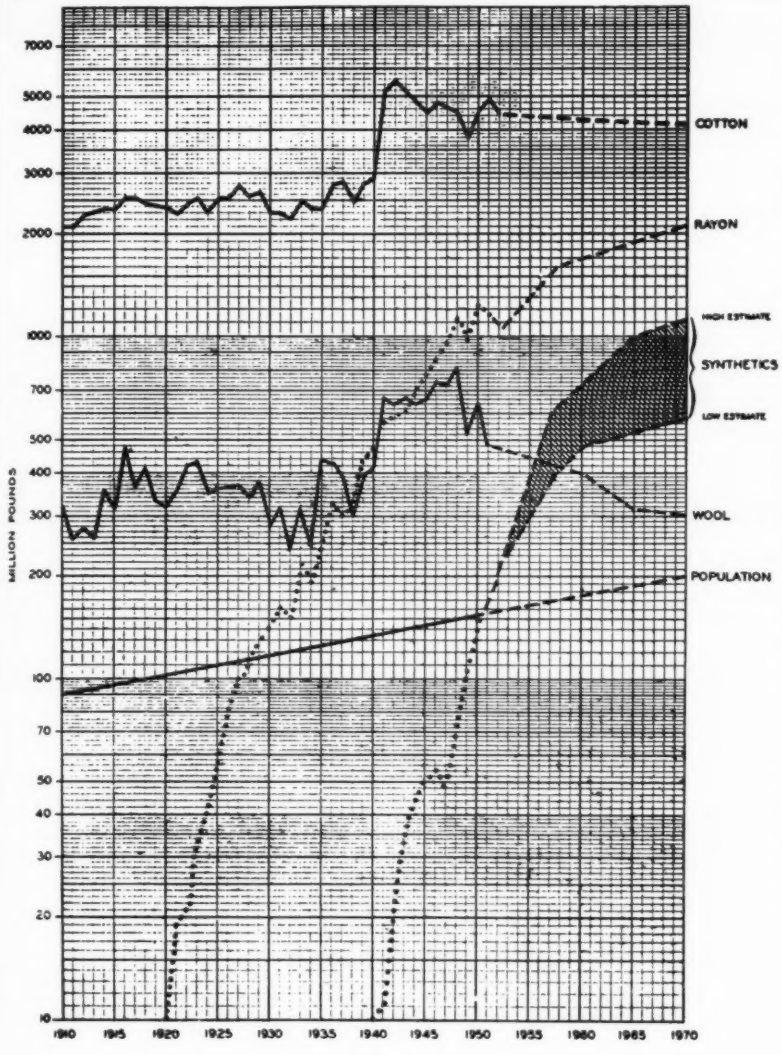


Figure 1

Source: 1910 to 1951—USDA Statistical Bulletin 89 & Textile Organon
1952 to 1970—Arthur D Little, Inc, Projections

NOTE: Your attention is called to the fact that the above chart was prepared in 1952, and projections were made from data available at that time.

fiber. Usually, increased dyeability is achieved at the expense of physical characteristics which the textile mill wishes to maintain.

However, there is one avenue of approach which seems worthy of more consideration than has been given to date. This refers to a study of the chemical structure of the dyestuffs, and the fabrication by the dyestuff-manufacturing concerns of newer dye structures to color the newer synthetic fibers. It has been shown that the employment of dyes according to classes of application has not been too effective in coloring the newer hydrophobic fibers, yet certain members of a given application class or of a chemical class have worked. We believe the dyemakers will eventually formulate new dyes for the new chemical fibers—eliminating, in many instances, the use of swelling agents, mordants, pressure-high-temperature methods, and prepolymerization additives—by chemically building into the dye molecule chromophoric groups for the modern fibers. Such dye molecules, elaborated and expanded over the years, should go far to enable union-cross-dyeing methods on cloths composed of the natural and chemical fibers.

It is with this object in view that this paper is presented, to stimulate discussion and research on the chemical constitution of those dyes which work best on the hydrophobic fibers in the hope that a clue leading to the solution of this problem will be found in textile dyehouses and in the chemical laboratories of dyemaker and mill.

EXPERIMENTAL

A) DISPERSE (ACETATE) DYES ———A group of representative acetate dyestuffs were dyed on acetate, nylon, Dynel, Dacron, Acrilan, and Orlon stock. Particulars of the fibers employed were as follows:

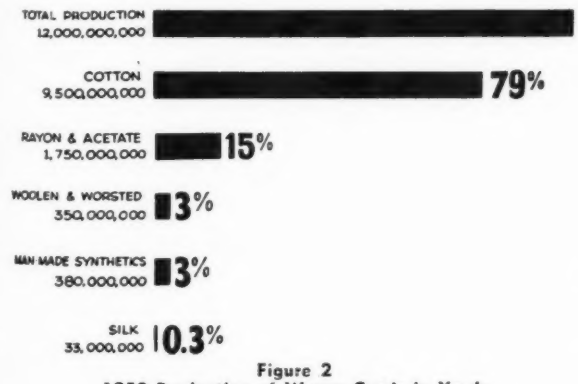


Figure 2
1952 Production of Woven Goods in Yards
Source: America's Textile Reporter

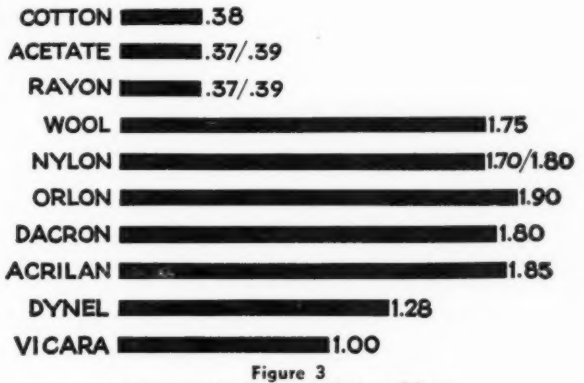


Figure 3
Comparative Costs of Various Fibers
Source: America's Textile Reporter

acetate	5.5-denier, 5" bright
nylon	6-denier, 2½" bright
Dynel	3-denier, 4" sliver
Dacron	6-denier, semidull staple
Acrilan	3-denier, 2½" semidull staple
Orlon	3-denier, 2½", type 42

All dyeings were made with 2% dyestuff, and 0.5% Calgon owf (on wt of fiber) in the dyebath. Standard stock solutions of the dyes were made up, and aliquot portions thereof were used. Dyebath ratio, 40:1.

The acetate was dyed at 190°F for 1½ hours with no further assistant. The nylon was dyed at 190°F for 1½ hours with 20% Glaubers salt as assistant. The Dynel dyeing was started with 50% Glaubers salt owf, boiled ½ hour, then 50% Glaubers salt owf was added again, the bath was boiled another half hour, and cooled back to 140°F. The Dacron, Acrilan, and Orlon were dyed at the boil for 1½ hours each with no additional assistants. Dyeings were dried in a hot-air dryer at 212°F.

The dyeings were carded by hand and mounted for Figures 4 and 5.

Among the dyeings with disperse (acetate) colors it will be noticed that, of the six fibers under study, there are two groups of three fibers each which are alike unto themselves and in contrast with the other group. The first group is composed of acetate, nylon, and Dynel, which dye similarly. The second group embraces Acrilan, Orlon, Dacron. The first group absorbs disperse colors fairly well, whereas the second group shows poor tinctorial value, although the actual dyebath exhaustion appeared reasonably good.

It will be noted that the dyeings on nylon, Dynel, Dacron, Acrilan, Orlon are duller than those on acetate. This is taking into account that the acetate stock was lustrous. The order of dullness appears roughly in the order noted above, with nylon the least, and Orlon the dullest.

In addition, the yellows and oranges become redder, the reds, rubines, and violets become bluer, and the blues become greener when dyed on the hydrophobic fibers, referred to the shade obtained on acetate.

As an aside, the experimentally produced hydrophobic fibers X-51 (American Cyanamid), M-24 (Tennessee Eastman) are very much like Acrilan in dyed shade and dyeing characteristics, while Zetek (B F Goodrich) is nearer to Orlon than to any of the other fibers, although this last fiber is still much different from Orlon in dyeing properties.

In Table II the chemical constitutions of the disperse (acetate) dyes employed in coloring the fibers under examination have been noted in the instances where they have been known to us.

Those acetate dyes having an anthraquinone nucleus yield the best light fastness for the most part, although certain diphenylamine derivatives stand up well in this respect. Gas-fume susceptibility is not a factor with most of the synthetics as it is with acetate fiber, hence the anthraquinone types of disperse colors may be used with little or no danger of gas fading on nylon, Dacron, Dynel, Acrilan, and Orlon. This phenomenon may be explained by the high hydrophobic character of these fibers. Conversely, those dyes requiring diazotization with nitrous acid are applied on these synthetics only by special techniques since the nitrous acid has great difficulty in penetrating to the dye on or in the fiber.

It will be noted that no dyes have carboxylic or sulfonic groups with the exception of Orange GL. In this case, because of hydrolysis during dyeing, the actual dye deposited is the free amine. Hydroxyl groups either in the side chain or in the ring structure plus oxygen atoms, especially ketonic oxygen such as is found in the 9, 10 positions in anthraquinone, seem to make for better dyeability of the disperse (acetate) colors on the newer hydrophobic fibers. Phenolic hydroxyl groupings, such as are noted in Acetate Yellow M and Acetate Yellow G, probably work as built-in "swelling agents", improving dyeability. This effect is accented when this group is located in the para position as in Yellow M. The dyeability of this particular color should be, and is, uniformly good on the synthetic fibers. Free primary-amine groupings possess certain dye value because of a basic nature and attraction for hydrophobic fibers. Ethylenic groups, hydrophobic in nature, exert a positive dye influence on these fibers.

TABLE I

COMPARISONS OF 2% DYEINGS ON VARIOUS FIBERS WITH 2% DYEINGS ON ACETATE

	Nylon	*Dacron*	*Acrilan*	*Dynel*	*Orlon*
Latyl Yellow YL	r sli w	r vw	r vw	r sli w	r vw
Celanthrene Yellow GL	r w	r w	r vw	r sli w	r vw
I/C Acetate Yellow G	vr sli w	r w	r vw	— sli w	— vw
I/C Acetate Yellow RLF-40	r sli w	r vw	r vw	r sli w	r vw
I/C Acetate Yellow M	vr sli w	r sli w	r sli w	r sli w	r sli w
I/C Acetate Orange GL	vvr s	r —	r sli w	r s	— sli w
Celliton Fast Pink RF	b —	b —	b vw	b —	b vw
Celliton Fast Pink BA	vvb —	b w	vb vw	b w	b vw
I/C Acetate Pink 3B	vvb —	vb vw	vb vw	b w	b w
I/C Acetate Scarlet B	vvb —	b vw	b vw	b —	b vw
I/C Acetate Rubine 3B	vvb —	b vw	b vw	vb —	b vw
I/C Acetate Red Violet RRLF-40	vb —	b vw	b vw	b sl w	b w
Latyl Violet B	b sli w	b —	b vvw	b —	b vvw
Celanthrene Brill Blue FFS	— —	g w	g vw	g sli w	g vvw
Eastman Blue GLF	g w	g vw	g vw	g vvw	g w
I/C Acetate Blue BGLF	g w	g w	g w	g w	g vw

LEGEND

r	redder	g	greener
vr	much redder	w	weaker
vvr	very much redder	sli w	slightly weaker
b	bluer	vw	much weaker
vb	much bluer	vvw	very much weaker
vvb	very much bluer	—	about equal

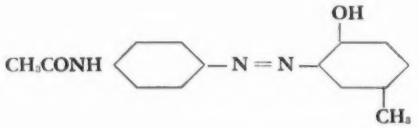
TABLE II

TABLE II
CHEMICAL CONSTITUTIONS OF DISPERSE (ACETATE) DYES

Latyl Yellow YL —

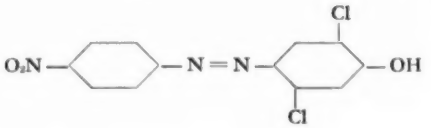
Celanthrene Yellow GL — An anthraquinone derivative

I/C Acetate Yellow G

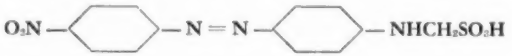


I/C Acetate Yellow RLF-40 — Diphenylaminesulfonamide ethyl ether

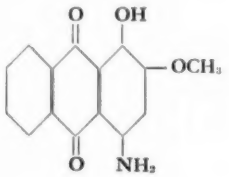
I/C Acetate Yellow M



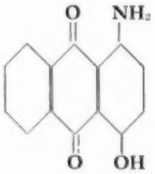
I/C Acetate Orange GL



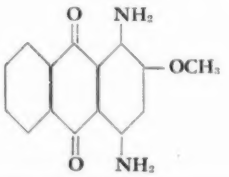
Celliton Fast Pink RF



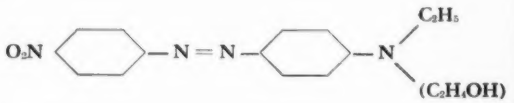
Celliton Fast Pink BA



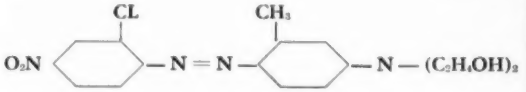
I/C Acetate Pink 3B



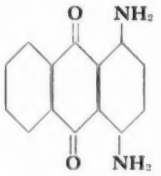
I/C Acetate Scarlet B



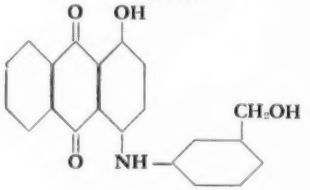
I/C Acetate Rubine 3B



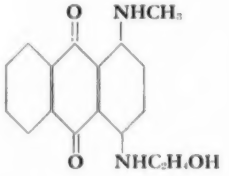
I/C Acetate Red Violet RRLF-40



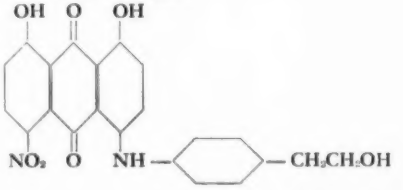
Latyl Violet B — USP 2,353,108



Celanthrene Brill Blue FFS



Eastman Blue GLF — USP 2,641,602



I/C Acetate Blue BGLF — Similar to Eastman Blue GLF

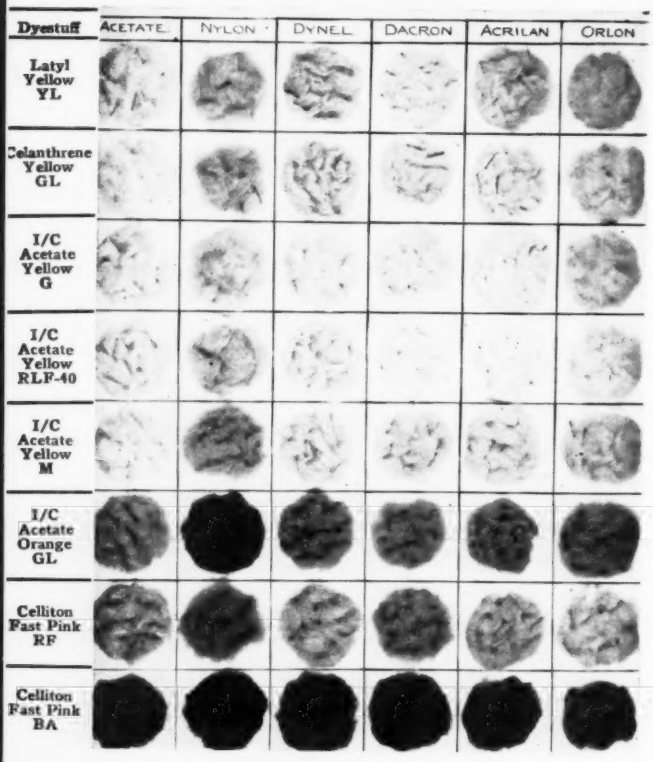


Figure 4
Disperse Colors

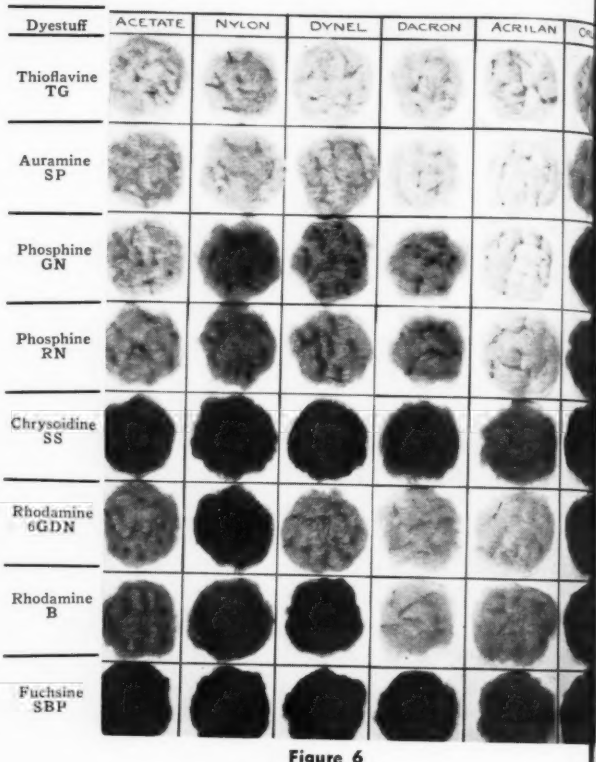


Figure 6
Basic Colors

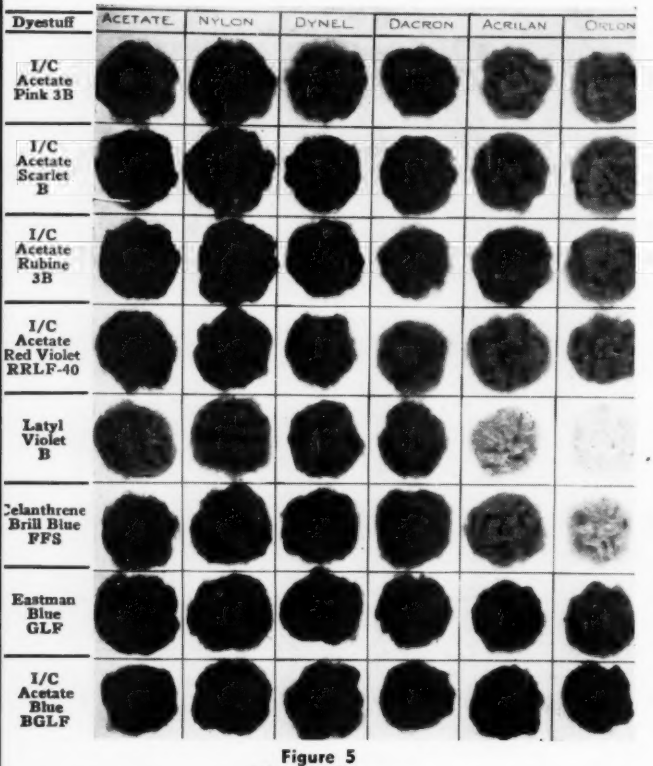


Figure 5
Disperse Colors

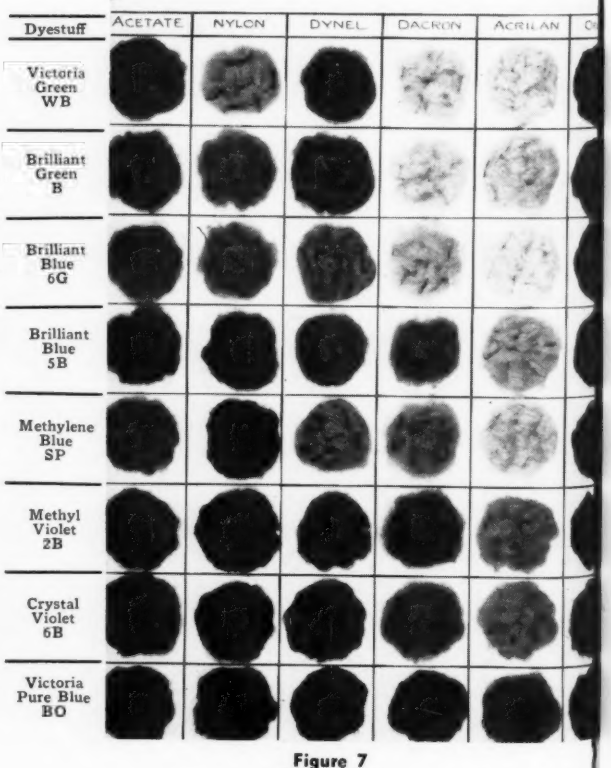


Figure 7
Basic Colors

B) BASIC DYES ——— Representative basic dyestuffs were dyed on acetate, nylon, Dynel, Dacron, Acrilan and Orlon stock.

All dyeings were made with 2.0% color and boiled for 1½ hours. The different fibers were dyed as follows:

acetate	2.0% acetic acid, 56%
nylon	1.0% sodium acetate
Dynel	1.0% Calgon
Dacron	1.0% Calgon
Acrilan	2.0% sulfuric acid, 66° Bé
Orlon	2.0% acetic acid, 56%

In addition to the standard type of basic dyes, a special group of basic colors known in this country as the Genacryl colors was employed. In Europe these colors are known as Astrazones. These were dyed with 1.0% acetic acid, 56% owf, and boiled 1 hour, cold-rinsed, and air-dried at 212°F. The bath ratio was 40:1.

In the dyeings with ordinary basic colors it will be noticed that Orlon dyes as well as acetate, while, with the special basic colors (Genacryls), Orlon dyes better than acetate, nylon, Dynel, Dacron or Acrilan. In most cases Dacron and Acrilan have not dyed well with basic colors. The poor dyeings on Acrilan as contrasted with good dyeings on Orlon were somewhat surprising, since Acrilan and Orlon are of the same general polymer family.

Certain dyestuff homologues will dye similarly on the same fibers; note Victoria Green WB and Brilliant Green B. These two dye sisters color acetate, Dynel, and Orlon best, and Dacron, Acrilan, and nylon poorest. Another example is the heavy dyeings on nylon of Methyl Violet 2B and Crystal Violet 6B, and their similar depths of shade of one dye versus another on the five other fibers.

The basic dyes, as is shown by Table IV, do not have free hydroxyl groups but rather a preponderance of amine groupings, usually substituted with alkyl radicals, plus a plurality of ring nuclei. A basic dyestuff, with free or substituted amino groups, containing several hydroxyl groups attached either to the ring or as a side-chain alcohol, might well yield good dyeability on the hydrophobic fibers.

An interesting commentary is the surprising light fastness obtained with certain basic colors on certain of the newer fibers. The Genacryl Yellows and Oranges are good to light on Orlon, while the two Genacryl Reds are far more light fast than most basic reds.

The Genacryl colors probably will be the type used by wool shoddy mills to cover Orlon nubs. The use of basic dyes for the coloration of synthetic fibers should not be hastily rejected solely on grounds of preconceived poor light fastness. A basic dye may be poor to light on wool but good to excellent to light on Orlon. On Orlon, practically every one of the sixteen ordinary basic dyes shown had extremely poor light fastness, yet several of the special basics on Orlon were good, i e, withstood 80 hours' exposure in a Fade-Ometer.

TABLE III

COMPARISONS OF DEPTHS OF BASIC-TYPE DYEINGS ON VARIOUS FIBERS WITH DYEINGS ON ACETATE

	Nylon	*Dynel*	*Dacron*	*Acrilan*	*Orlon*
Thioflavine TG	w	sli w	vvw	vvw	s
Auramine SP	sli w	w	vvw	vvw	s
Phosphine GN	s	vw	vvw	vvw	s
Phosphine RN	s	w	vvw	vvw	s
Chrysoidine SS	s	s	sli w	w	s
Rhodamine 6GDN	vs	sli w	vvw	vvw	s
Rhodamine B	s	sli s	vvw	vvw	s
Fuchsine SBP	vs	w	w	vw	sli s
Victoria Green WB	vvw	sli w	vvw	vvw	s
Brilliant Green B	w	sli w	vvw	vvw	—
Brilliant Blue 6G	w	w	vvw	vvw	s
Brilliant Blue 5B	sli w	w	vw	vw	sli s
Methylene Blue SP	vs	vw	vvw	vvw	vs
Methyl Violet 2B	s	vw	vw	vw	s
Crystal Violet 6B	s	vw	vw	vw	—
Victoria Pure Blue BO	s	w	w	w	—
Genacryl Yellow 5G	vvw	vvw	vvw	vvw	s
Genacryl Yellow 3G	vvw	vw	vvw	vvw	s
Genacryl Orange G	vw	vw	vvw	vvw	s
Genacryl Orange R	w	w	vvw	vw	s
Genacryl Pink G	vw	w	vvw	vvw	s
Genacryl Red 6B	w	w	vvw	vvw	s
Genacryl Blue 6G	vw	w	vvw	vvw	s
Genacryl Blue 5B	w	w	vvw	vw	s

LEGEND

w	weaker	s	stronger
sli w	slightly weaker	sli s	slightly stronger
vw	much weaker	vs	much stronger
vvw	very much weaker	—	about equal

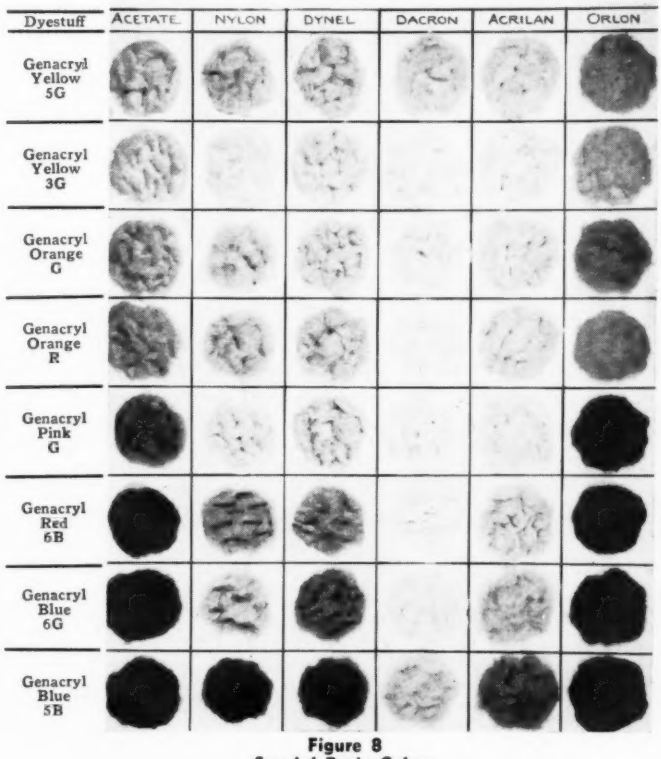
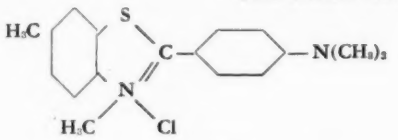


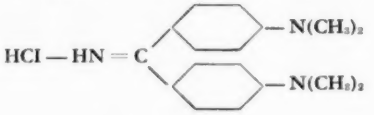
Figure 8
Special Basic Colors

TABLE IV
CHEMICAL CONSTITUTIONS OF BASIC DYES

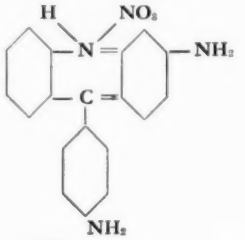
Thioflavine TG



Auramine SP

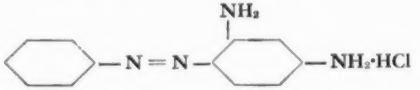


Phosphine GN

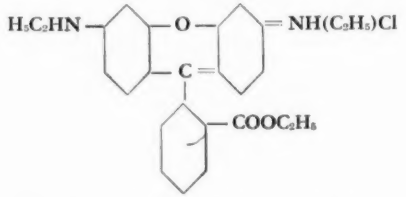


Phosphine RN — Similar to GN

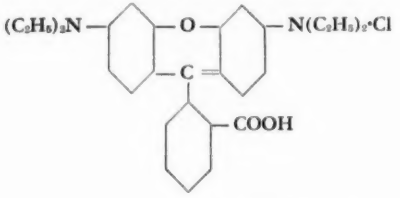
Chrysoidine SS



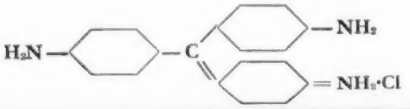
Rhodamine 6GDN



Rhodamine B



Fuchsine SBP

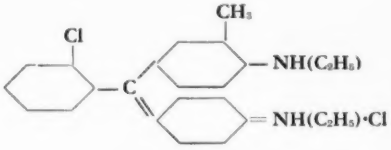


Victoria Green WB
(Malachite Green)

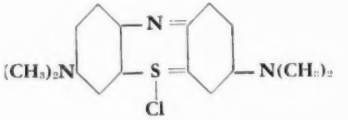
Brilliant Green B

Brilliant Blue 6G
(Seto Glaucine)

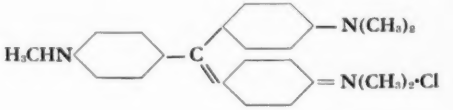
Brilliant Blue 5B
(Seto Cyanine)



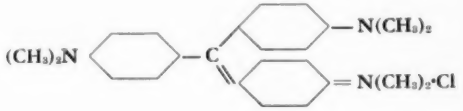
Methylene Blue SP



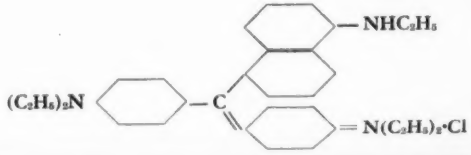
Methyl Violet 2B



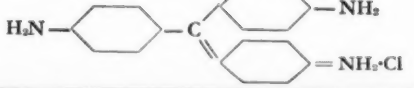
Crystal Violet 6B



Victoria Pure Blue BO



Fuchsine SBP



Victoria Pure Blue BO

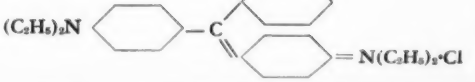
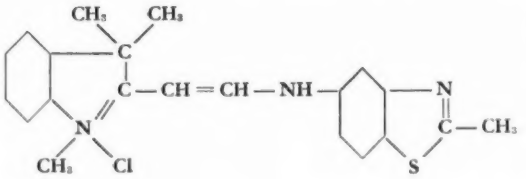
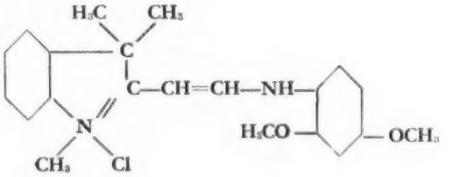


TABLE IV-A
CHEMICAL CONSTITUTIONS OF SPECIAL BASIC COLORS

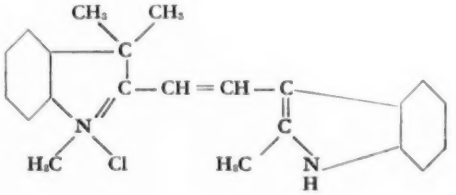
Genacryl Yellow 5G



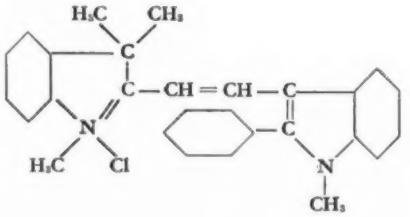
Genacryl Yellow 3G



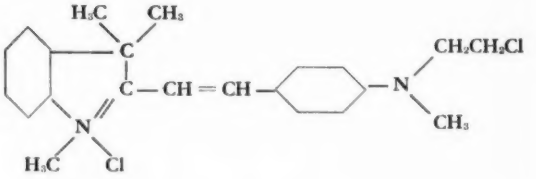
Genacryl Orange G



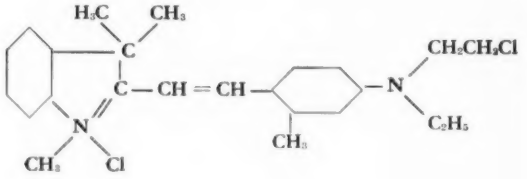
Genacryl Orange R



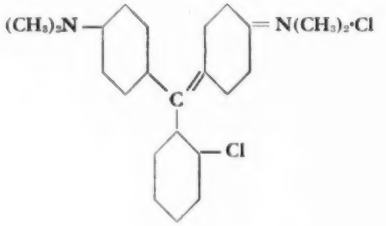
Genacryl Pink G



Genacryl Red 6B



Genacryl Blue 6G



Genacryl Blue 5B

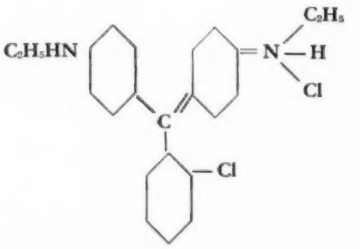
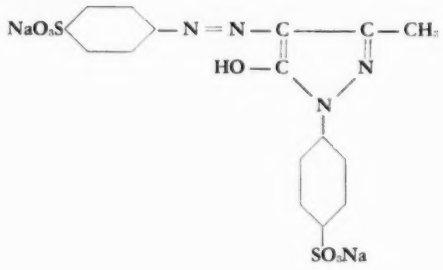
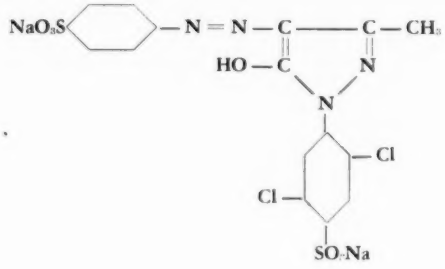


TABLE V
CHEMICAL CONSTITUTIONS OF ACID COLORS

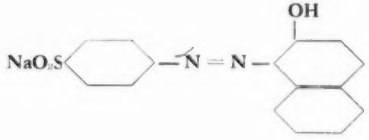
Tartrazine



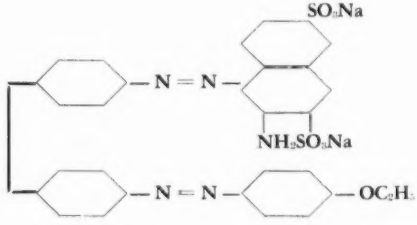
Fast Light Yellow 2G



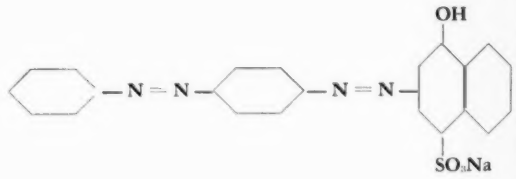
Acid Orange II



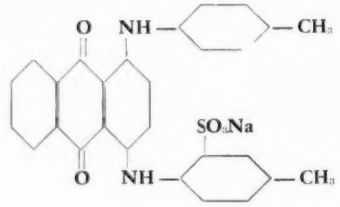
Milling Orange G



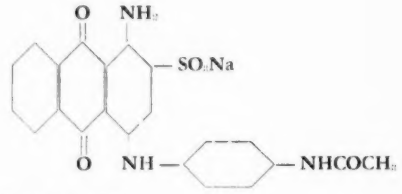
Cloth Red G



Alizarine Cyanine Green G



Alizarine Direct Blue A2G



Alizarine Supra Blue A

Similar to A2G

Fast Wool Cyanone 3R

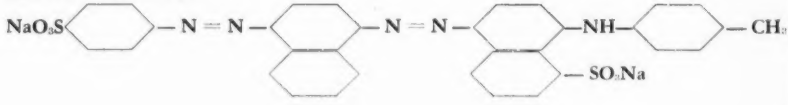
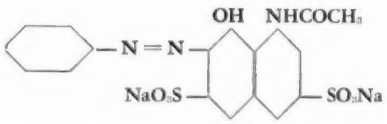


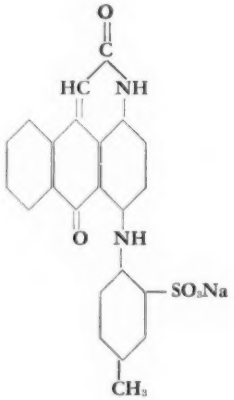
TABLE V (Concluded)

TABLE V (Concluded)

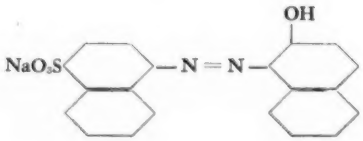
Amacid Azo Phoxine G



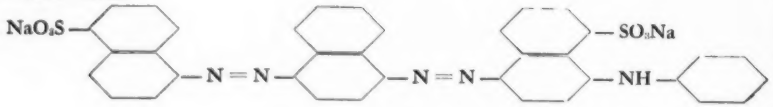
Anthralan Red B



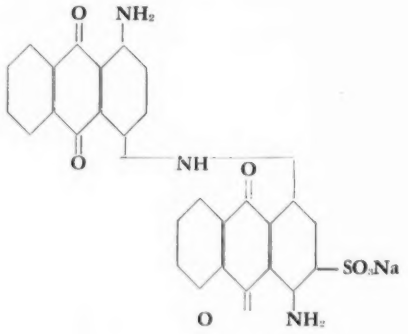
Fast Red ALS



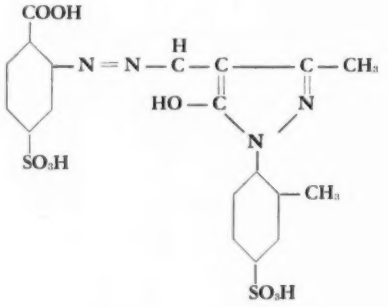
Durol Black 2B



Alizarine Light Grey 2BLW



Neolan Yellow BE



Irgalan Yellow GL

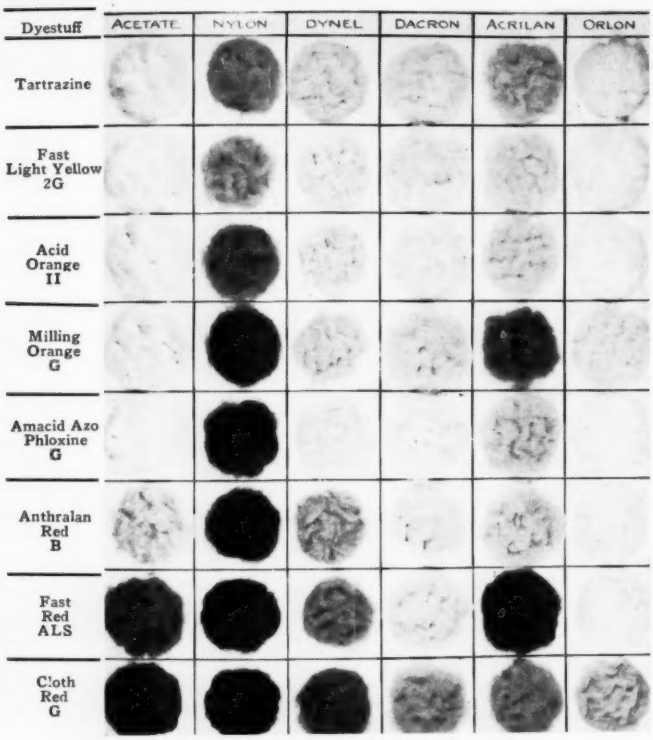


Figure 9
Acid Colors

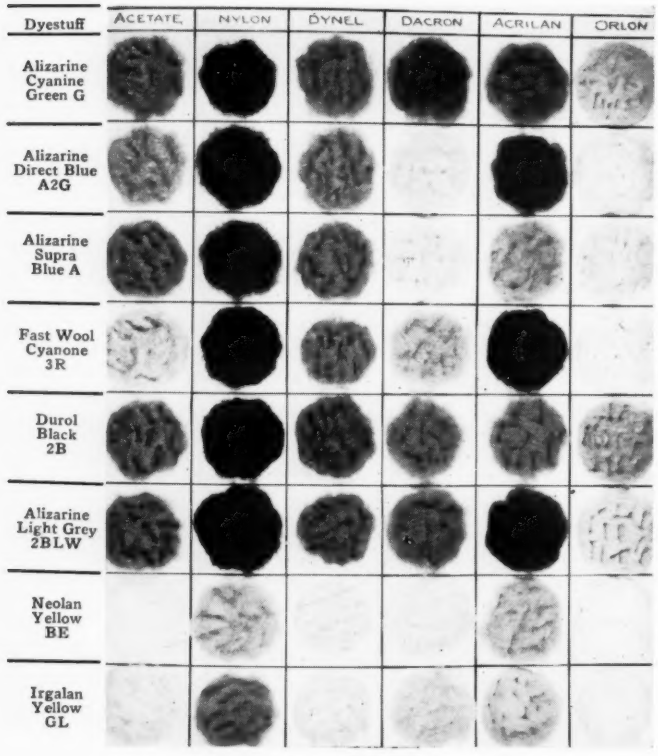


Figure 10
Acid Colors

C) ACID DYES INCLUDING MILLING AND METALIZED TYPES——A group of representative acid dyes including some milling and metalized types were dyed on acetate, nylon, Dynel, Dacron, Acrilan and Orlon stock. All dyeings were made with 2.0% color with the exception of Durol Black 2B which was dyed at 6.0%.

The following colors were dyed with 2.0% acetic acid, 56%:

Amacid Phloxine G
Fast Light Yellow 2G
Acid Orange II
Milling Orange G
Alizarine Light Grey 2BLW

With Fast Red ALS, Fast Wool Cyanone 3R and Alizarine Direct Blue A2G, 4.0% sulfuric acid, 66° Bé, was used, while 6.0% sulfuric acid, 66° Bé, was used in the case of Neolan Yellow BE. Two per cent ammonium acetate was used for Irgalan Yellow GL. Fifty per cent Glaubers salt was used with Durol Black 2B and thirty per cent Glaubers salt with Alizarine Supra Blue A, Alizarine Cyanine Green G, Anthralan Red BA and Cloth Red G.

The dyeings were brought up to the boil and boiled 1½ hours, cold-rinsed, and air-dried at 212°F. Bath ratio was 40:1.

The acid colors used in our experiment have yielded consistently good dyeings in every instance on nylon; they have yielded poor dyeings, only light stains or no stains at all on the other five fibers under consideration. However, there have been the usual exceptions, such as Alizarine Direct Blue A2G, Fast Wool Cyanone 3R, Fast Red ALS, Neolan Yellow BE, which gave good dyeings on Acrilan. This would lead us to believe that sulfuric acid is necessary in dyeing Acrilan, since the above colors are dyed on wool with sulfuric acid and had sulfuric acid in the dyebath. This is, in fact, the recommendation of the manufacturer of Acrilan. Hence, we would expect to obtain much better dyeings with the acetic-acid colors on Acrilan if we repeated them with sulfuric acid in the bath.

On Orlon it is evident at present that we must employ the cuprous-ion method with acid colors. Eventually, we hope the dyestuff concerns will be able to come up with newer types of acid dyes, as they have with basic colors, that will serve for the dyeing of the synthetics.

It will be noted that the use of sulfuric acid in dyeing hydrophobic fibers tends to give a harsher hand than does acetic acid.

Most acid colors should leave acetate fiber white or very mildly stained. The use of acid in the dyebath tends to drive acid colors onto acetate. In the case of a fabric composed of nylon and acetate and dyed with acid colors, for example, the nylon would selectively dye and probably

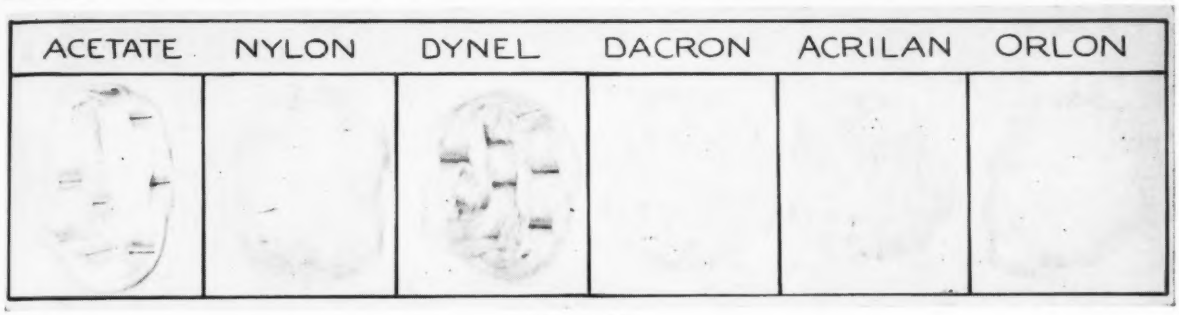


Figure 11
Undyed Fibers

the acetate would be left white, even in those cases in Figures 9 and 10 where staining of the acetate took place when acetate alone is present.

Under the experimental conditions, Dacron and Dynel dyed poorly with acid colors. Dyeing assistants and special techniques are needed here until new dyes are produced.

SUMMARY

Several hundred dyeings of various classes of dyestuffs were made on the hydrophobic fibers under study. Three hundred and thirty-six such dyeings are shown mounted. We have shown the natural dye affinity of divers dyes on the several fibers by dyeing without special assistants.

Disperse (acetate) dyestuffs dye each and every hydrophobic fiber under examination. A positive affinity was observed for these acetate dyes, while the basic colors were fiber-selective, and the acid colors, much more fiber-selective.

In much the same manner as an alcohol acts as a natural solvent in a solvent-water mixture, so do acetate dyes act as bridging agents between an aqueous dyebath and a "solvent-type fiber". The dyes that color the chemical fibers best are those having hydroxyl or ketonic groupings. As the ketonic grouping, $-C=O$, often gives rise to hydroxyl groups from tautomeric isomerism, the affinity of dyes containing ketonic groups may also be based on the hydroxyl radical. This may explain, too, why vat dyes color some of the hydrophobic fibers.

The hydroxyl groups may be in the side chain as an alcohol or may be in the ring structure as a phenol or naphthol.

Sulfonic or carboxylic groups in the dye molecule detract from the dyeing of most of the hydrophobic fibers. These groups are present for solubilizing purposes, or because the dye was used for dyeing a natural fiber. Nylon is the apparent exception to this, the polyamide linkage bearing some similarity to wool in its dye selectivity, yet with important differences.

The various techniques, such as cuprousion mordanting, the use of swelling agents, high-pressure methods, prepolymer mix additives, employed to color the newer hydrophobic fibers appear to be application bridges. Some of these will disappear as newer dyes for the modern fibers are synthesized. This was the case in the 1920's when new acetate dyestuffs supplanted weird coloration methods for the fledgling acetate fiber.

In this paper, the Northern New England Section hopes to have pointed the way to the dyemaker towards a new line of colors for the chemical fibers which will handle well in the mill and yield good fastness properties and customer satisfaction. The textile industry salutes the chemical and dye industry and asks their help in producing modern dyes for modern fibers, which the textile industry will employ and the public will enjoy.

AATCC Monograph No. 2

"THE APPLICATION OF VAT DYES"

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DR H C CHAPIN, SECRETARY, AATCC
P.O. BOX 28 • LOWELL, MASS

HOW THE SYSTEM OF YARN MANUFACTURING, AS WELL AS THE FIBER'S PHYSICAL PROPERTIES, AFFECT THE CHARACTERISTICS OF YARN

JOHN B CARON
Caron Spinning Company

How the characteristics of worsted and synthetic spun yarns are determined by the system of manufacturing on which these fibers are processed, as well as the physical properties of the fiber, are discussed.

Physical properties, such as staple length, crimp, luster, and quality or denier, each impart certain characteristics to a yarn that are determining factors in the type of halfhose to be produced. In wool these physical properties are also affected by the breed of sheep, country of origin, and even the particular section of the country in which the sheep are raised.

Besides the physical properties of a fiber, the system of manufacturing contributes materially to the different characteristics of a spun yarn. In addition to the Bradford, French, and woolen systems of manufacturing, there has now been added the American system and modifications of the cotton system, as well as other composite systems that are difficult to label with an adequately descriptive name.

These various manufacturing systems and the different characteristics of the yarn produced on each of these systems are explained.

INTRODUCTION

THE buyer of a spun yarn, whether it be made from a synthetic fiber or wool, is now confronted with the problem of whether he should buy yarn made on the Bradford system, American system, French system, cotton system, woolen system or some other system that has not as yet been adequately named. Not too many years ago, buying a worsted yarn was relatively simple, as we had only the Bradford, French and woolen systems with which to become familiar. Today the American system is in operation. Cotton spinning mills are producing synthetic yarns on their equipment, and many cotton mills have modified their equipment to accommodate longer-staple synthetic fibers. Mills have borrowed ideas from other systems, and still other methods of manufacturing are in the stage of development.

An interesting thing to observe is that each of the systems imparts a different characteristic to spun yarn, and it is these different characteristics about which I would like to talk today.

CHARACTERISTICS OF VARIOUS SYSTEMS OF YARN SPINNING

To understand why yarn spun on the various systems of manufacturing have different characteristics, it is necessary first to understand the essential features of each system. In all systems of manufacturing spun yarn, it is essential that the drafting of the fibers be closely controlled. If the fibers were not controlled so that they flowed by each other smoothly, an intermittent or jerking action would result. This would mean that there would be thick and thin spots in the yarn. Where too many fibers were drawn through, there would be a thick spot, and, of course, this would have to be followed by a thin spot because there would be fewer fibers to follow. The method of controlling the fibers during the process of drafting as well as the length of the fiber used constitutes the essential differences between the various systems of manufacture. Staple length of fiber is important because the loft or bulking power of a yarn depends a great deal on the twist in the yarn. An advantage of using a long-staple fiber is that less twist can be used, thus giving a good loft, while maintaining good breaking strength.

WOOLEN SYSTEM —— Woolen yarn is made from relatively short fiber on a rather abbreviated system. The fibers are carded, and, as they leave the card, a rubbing action takes place, which condenses the continuous end into what is known as roving. This condensing is necessary so that there will be friction between the fibers to give even control during the drafting in spinning. The roving goes directly to spinning without any combing. This feature is one of the important differences between the woolen and other types of processing.

In woolen yarns the fibers are only partially parallel. Because of this the yarn has a rather rough, fuzzy appearance in comparison with a worsted spun yarn. The evenness of the yarn is not comparable with a worsted yarn, and for all practical purposes a 7-run, which is equivalent to 20s worsted count or a 13s cotton count, is as fine as it is practical to spin on the woolen system. The advantages of the woolen system are its low cost due to the few operations and the utilization of short fibers. The latter advantage means a very substantial saving in raw material. Short wool is cheaper than good staple wool, and furthermore, waste material can be used.

FRENCH SYSTEM —— The other extreme from a woolen-spun yarn is French-spun yarn. For quality these yarns are probably outstanding. The French system utilizes pin control during drafting in all operations of drawing and roving and uses fibers that average about 3" in length but may contain a good percentage of both longer and shorter fibers. Intersecting gill boxes are used in the first part of the operation, where the fibers are drawn or drafted through fine metal fallers, the closely set pins of which control and parallelize the fibers. In the later process of making roving, a cylinder set with very fine pins, called a porcupine, is used to control the fibers during drafting. In the French system, a rub apron is used to condense the fibers to give some strength to the slubbing and roving. Unlike any other system, French yarn is spun from roving that has no twist. This helps contribute loft to the yarn because the fibers are worked so gently.

The French system produces a yarn that has excellent loft, soft handle and good evenness. The excellent loft and the soft handle are attributable to the low twist with which it is possible to spin on this system, as well as to the short fibers that are in greater abundance in proportion to long fibers than in other systems except woolen. Because of the

* Presented at the Annual Convention in Chicago, Illinois on Sept 18, 1953, before the Hosiery Session with A O Alexander presiding. Submitted to the Dyestuff Reporter by the Editor of Proceedings on April 22, 1954.

soft twist the short fibers are not anchored in the yarn, and this allows a certain "bloom" that is characteristic of French-spun yarns. One disadvantage of the system is that these yarns are more expensive to manufacture because of the larger number of operations.

BRADFORD SYSTEM——The Bradford system uses longer fibers than any other. The fibers are condensed together and the drafting is controlled by inserting twist. This is a true twist and not a false twist, such as that of the French-system rub aprons. A typical Bradford installation begins with a gill box (with pin control), and then the heavy strand of fibers is delivered onto a bobbin. The action of a rotating flyer, laying the heavy strands of fibers on the bobbin, inserts twist into the end. In the following operations, the fibers having been twisted together and thus more or less firmly anchored, all the fibers then draft with approximately the same resistance, and the drafting is evenly controlled. The Bradford system has five to seven operations, during which the end is slowly drawn down to a finer size in preparation for spinning.

Because it utilizes twist for control, the Bradford system can use a top that has both long and short fibers. The long fibers give strength to the yarn with a low twist, and the short fibers give loft. Bradford yarns are second only to French-spun yarns in loft and softness of hand. They are less expensive to produce than the French system but somewhat more expensive than the other systems.

AMERICAN SYSTEM —— The American system has fewer operations than the Bradford or French systems. This is due mostly to the fact that the fibers are drafted about twice as rapidly in the roving and spinning in the American system as they are in the Bradford or French. In the roving operation, the American system drafts the fibers while condensing them between aprons. The aprons also give the fibers a surface that offers resistance during drafting. Twist is inserted in the roving, much the same as in the Bradford system. During spinning, the twist in the roving as well as the apron controls the drafting of the fibers.

Because of the higher draft in the American system and also because the average length of fibers used on this system are shorter than those in the Bradford or French, more twist must be imparted to the yarn to give it adequate strength. Thus the yarns have a tendency towards leanness because of the greater twist. American-spun yarn generally does not have as soft a handle as Bradford- or French-spun yarns. However, these yarns do have a good, even appearance, and they are somewhat less expensive to manufacture as there are fewer manufacturing operations. Wool tops used on the American system must be carefully selected for staple length, and this can be a disadvantage because of limited selection. Also, this system has not been able to handle all types of medium- and low-quality wool successfully.

COTTON SYSTEM —— The cotton system has turned out large quantities of spun synthetic yarn. Much cotton equipment has been modified to take longer staple fiber so that it is now more properly termed the American system. This modified equipment is turning out both worsted and synthetic yarns, and the characteristics of the yarns are very similar to the American system.

The yarn spun on conventional cotton equipment, however, is different in that it must utilize a very short fiber, approximately the length of cotton. Because of the short length of fiber, quite a high twist must be inserted in the yarn, thus imparting leanness and some loss of soft hand. This system has an advantage, however, in that the number of operations are relatively few and the cost of producing yarn is low. As the cotton system best utilizes 1½-denier synthetic fibers, it can spin yarn of very fine count.

There are other systems of worsted-yarn manufacturing, but the French, Bradford and American and the modifications of each represent most of the production.

VARIATIONS IN SPINNING SYSTEMS——We have very briefly discussed the cotton system and the three main systems of worsted-yarn manufacturing, Bradford, French and American, but it is becoming more difficult to lay down a general rule as to the differences between these systems, since they are borrowing more and more features from each other.

It has been established that the excessive processing of fibers affects fiber properties, reducing both the strength and the elasticity of the yarn. The pin drafter was developed to eliminate several processes of drawing, and this machine, which is quite versatile and flexible in performance, has now been successfully adopted by the Bradford, French and American systems. This is a good illustration of how similar the various systems are becoming in certain operations.

The pin drafter is essentially a high-speed, close-control, intersecting gill box utilizing pin control. The French system has gill boxes followed by porcupine drawing operations, both of course, with pin control. The Bradford system has its heavy-duty gill box, followed by heavy drawing frames and utilizing twist for control. Many mills using the Bradford and French systems have dropped their conventional equipment and have adopted the pin drafter because it eliminated operations, thus cutting down costs, yet maintaining good control of fibers and giving good-quality sliver.

The drawing frames of the American system have a number of rolls for control, similar to those that are used in cotton manufacturing. In fact, before the advent of the pin drafter, the American system of drawing, using rolls like those of the cotton system to control the fibers, was not too successful as it was very limited in the length of fiber it could properly process. The pin drafter was the answer to the American system's problem, as it introduced a machine that was extremely versatile and expanded the flexibility of the system. Today mills that are on the French system and those on the Bradford system and also those on the American system are all using pin drafters; therefore, up to a certain point in manufacturing, the systems in many mills are identical.

A further illustration of how the systems can become intermixed can be found in our own mill. For a number of years we have used the Warner and Swasey pin drafter in our drawing. We have nevertheless had conventional Bradford roving and spinning. We realize the economy in the short-cut American system, and we also realize the very fine quality of the French system. The ideal would be to achieve both the economy of the American and the quality of the French. As a result, we now have equipment in our plant that borrows from both the French and American systems, yet our spinning remains Bradford system, as we want to retain the desirable characteristics of a Bradford-spun yarn.

We have borrowed from the French system by utilizing pin control in our roving. This roving frame has fallers similar to the pin drafter. Twist is imparted to the roving as it comes off this machine, since twist is an essential feature of the control of the fibers during drafting for spinning.

In another type of roving frame, we have borrowed from the American system by developing a rover that utilizes aprons to condense and to control the drafting of the fibers. The yarn is still spun on the Bradford-type spinning frame, but with a normal draft so that we retain the characteristics of a Bradford-spun yarn.

The differences that I have discussed so far in comparing the various systems of manufacturing have been confined to the drawing, roving and spinning operations. The preparatory equipment that

takes the fiber in staple form and puts it into sliver is also quite varied. With the exception of the woolen system, all systems using wool first process the wool into combed top. Worsted tops are made on two different types of combs, the French, or continental, and the Noble, or Bradford. Both use cards of a similar type, but on the French system, a comb is used that takes out only the very shortest fibers. This, then, is the essential difference between the two. The Bradford, or Noble, comb has a higher production rate and thus gives basicly a lower cost of operation than the French-type comb, but the French has an advantage in that it makes a top out of shorter wool. There is thus a smaller precentage of short fibers removed, called noils, which are worth much less than the fibers left in the top. On both types of comb, vegetable matter, bits of paint and other foreign matter are also removed with the noils.

SPINNING SYNTHETIC STAPLE ——Synthetic fibers can be processed on either French or Noble combs as well as on conventional cotton equipment. The essential difference is that cotton cards will take only 1½ to 3" fibers, whereas the worsted-type cards and combs will take much longer fibers. The usual length of synthetic fibers on worsted equipment is 2½ to 6 inches.

Synthetic fibers are made in a continuous-filament form and a large number of filaments—perhaps 100 to 200 thousand—are grouped together in a large bundle called tow. This tow is actually perfectly even, so some people have logically figured that it was not sensible to take this perfectly even tow, to chop it up into short lengths and then to attempt to make it even again on conventional equipment. To take advantage of the inherent evenness of the tow, several direct tow-to-top processes have been developed, the most successful of which is the Warner & Swasey converter, developed by Pacific Mills. This machine has a blade that cuts the tow into any desired length, and it even produces a variable cut, if desired.

Tops produced from the converter can be used on any system. The American, Bradford and the modified systems are using the converter to make a low-cost, high-quality top. The converter has an advantage when blending different synthetic fibers. Tows can be blended together directly on the converter with maintenance of close control of the percentage of each fiber in the blend, as a tow can be held to close tolerances by the synthetic manufacturers. The converter may have an additional advantage in that some of the finer deniers, such as 1½-denier viscose tow can be produced freer of neps than can 1½-denier viscose staple.

TABLE I

COMPARISON OF MANUFACTURING SYSTEMS

Rank	*Soft Handle*	*Loft*	*Flexibility in Variety & Length of Fibers Used*	*Smoothness of Appearance*	*Economy*	*Elasticity*	*Evenness*
First	French	French	Woolen	Cotton	Woolen	French	Cotton
Second	Bradford	Bradford	French	American	Cotton	Bradford	Bradford
Third	American	American	Bradford	Bradford	American	American	French
Fourth	Woolen	Woolen	American	French	Bradford	Cotton	American
Fifth	Cotton	Cotton	Cotton	Woolen	French	Woolen	Woolen

Advantages	*System*	*Disadvantages*
Smooth, even yarn. Low cost.	*American*	Does not have as soft handle as a Bradford- or French-spun yarn. Restricted in choice of wool tops as to length.
Lofty, soft yarn. Synthetic yarns with a warm handle. Strength without excessive twist.	*Bradford*	Less expensive than French but more expensive than American system. Restricted to longer staple fiber.
Low cost. Very even and smooth yarn.	*Cotton*	Suitable only for 1¼" staple fibers. Somewhat lean-appearing yarn. Not as soft hand or as elastic as other systems.
Soft, smooth, lofty and elastic yarn. Versatile in use of variety of staple lengths and qualities of fiber. Synthetic yarns with a warm hand.	*French*	Expensive.
Low cost. Very wide choice of raw materials—can utilize waste and noils.	*Woolen*	Rough, fuzzy appearance. Not very good loft. 7-Run (20s worsted count or 15 cotton count) is as fine as it is practical to spin.

PERLOK SYSTEM —— Another direct tow-to-top process is the Perlok system. Many of you are fimiliar with super Orlon, processed either on the Perlok system or something similar. On this system, instead of being cut the tow is placed under tension and broken. Heat can be applied to the tow before this breaking process, thus drawing out the fiber to a finer denier.

The yarns made from material run through these breaking processes are quite soft, especially if the denier has been reduced. These yarns lose considerable loft, however, because of the considerable tension to which the fiber has been subjected. Also, a luster is added to the fiber, which may sometimes be undesirable. In other cases, such as in upholstery, this added luster is a desirable effect. The affinity for dyestuff is also changed by this breaking and drawing process, usually being decreased. The yarn made from this top tends to be somewhat hairier than those produced on most of the other systems.

While we are discussing super Orlon, it might be of interest to mention briefly type-81 Orlon. Type-81 Orlon has created a great deal of interest in the knitting-yarn business because of its softness. This fiber is spun from the manufacturing waste of the filament-Orlon plant. This waste, called fiber stock, has been successfully processed on the silk system. Type-81 Orlon has a softer handle than regular staple Orlon, but as it is a waste product, it is produced in variable lengths from short to quite long. The silk system has been the only one to process this fiber successfully. As this fiber has no crimp, it does not have much loft or bulking power. The short fibers in the yarn help to contribute some loft, while the lack of crimp contributes to the softness.

ADVANTAGES OF VARIOUS YARN-SPINNING SYSTEMS

Now let us summarize briefly some of the advantages and disadvantages of the various systems of manufacturing. The cotton system gives a very even and smooth yarn at low cost. It is suitable only for short staple, and the yarn has a lean appearance. The yarn is not so soft, so lofty or so elastic as yarn made on other systems.

The American system gives an even yarn at a low cost. It has the disadvantage of not having quite as soft a handle or as much loft as Bradford-spun or French-spun yarns, and this system is restricted in the choice of wool tops as to length and quality.

Bradford-system yarns are lofty and soft, and synthetics spun on this system have a warm hand. These yarns also have strength without having too much twist. This system is somewhat more expensive than the American system.

The French system gives a smooth, soft, lofty and elastic yarn. This system is versatile, as it can use a wide variety of staple lengths, and it has excellent control so that it may use many different qualities and types of fibers. A synthetic spun on this system also has a warm hand. It

has the disadvantage of involving more steps than the other systems and thus is more expensive.

Woolen-spun yarns are quite low in cost as there are few operations and there is a very wide choice of raw materials. The yarns have a somewhat rough and fuzzy appearance and do not have good loft. This system has the disadvantage of being limited to the spinning of coarser yarns.

If you are confused by the name of a manufacturing system and do not know whether it is Bradford, French, American, cotton or a modification of one of those, then the best course of action is to be guided by the staple length of the fiber as well as the twist in the single yarn. If you are buying plied yarn, the twist in a single end is still of the most importance. If you are interested in closely analyzing the yarn that you purchase, it might be a good idea to get a twist tester. One twist tester is sold by Alfred Suter of New York City. After the yarn is unraveled and the twist measured, it is fairly simple to draw out the staple from the untwisted yarn and to measure its length.

Cotton-system yarn will have a 1½-inch staple. American system yarn will have a 2½- or 3-inch staple, and the staple of the Bradford system will usually be approximately 4½-inches in the case of synthetics and quite variable in the case of wool. The average fiber length of wool spun on the American system is about 3 to 4 inches, but some fibers are as short as 1½ inches and some are as long as 8 inches or more. French-system synthetics may be from 2½ to 4 inches in fiber length, and yarn spun from wool on this system will be even more variable in fiber length than Bradford-system yarn, but the average fiber length will be shorter. Woolen-spun yarn will have mostly short fibers from 1 inch to 2 inches in length.

Cotton-system yarns will have the most twist in the single followed by American-system yarns. Bradford and French twists are quite similar to each other and are softer than either cotton-spun or American-spun yarns.

PILLING OF HALF HOSE———Pilling is a problem that confronts manufacturers of half hose, it has been a subject of much discussion, and I would like to discuss it very briefly. When nylon was first used in half hose, Du Pont strongly recommended a large amount of twist in the single yarn to minimize this pilling problem. But as twist is added, the soft hand of the yarn is lost, and therefore we were confronted with the problem of minimiizng pilling and losing soft hand, or on the other hand of retaining soft hand and running the risk of having a bad pilling problem.

It was found that one or two additional turns of twist in the single did not make much difference in pilling, but it made an appreciable difference in the loss of the soft hand of the yarn.

How staple length affects pilling has also been a subject of much discussion. The popular theory is that if there are more ends sticking up from the surface of the yarn, there will be more pills. This would tend to indicate that a yarn made from long staple fiber has less tendency to pill than a yarn made from a short staple fiber.

RELATION OF FIBER PROPERTIES TO YARN CHARACTERISTICS

The discussion up to now has been concerned primarily with the different characteristics imparted to yarn by the machinery on which the yarn was processed. The physical properties of the fiber itself are quite important when it comes to discussing yarn characteristics, so I would now like to talk briefly about how these properties, especially with regard to wool, affect the characteristics of yarns.

WOOL———The physical properties, such as staple length, crimp and quality, are accurately controlled in the process of manufacturing a synthetic fiber. A natural fiber, such as wool, has far greater variations, as the physical properties of the fiber depend upon the breed of sheep and the geographical and climatic conditions under which the sheep are raised. The staple length and strength of a fiber are primarily a matter of healthy breeding and rearing of sheep. A starved sheep cannot grow a long, strong fiber. However, even though a sheep may be well bred and healthily reared, each breed of sheep grows a wool with a characteristic all its own. Some sheep are bred primarily for good-quality wool, such as the Australian Merino. Some sheep are raised primarily for meat, such as the black-faced Hampshire in the midwestern part of our country. Other sheep are bred to be all-purpose sheep, such as the Corriedale, developed in New Zealand and also widely used in South America.

The Australian Merino grows a wool of fine quality, good length, strength and good crimp. Its lamb, however, does not grow very fast, and thus the Merino is not an efficient meat producer. On the other extreme, there is the black-faced Hampshire, of which there are quite a few in this country. These sheep produce a very fast-maturing lamb and a lot of them, twins being quite common, but their wool is of medium grade, 50s to 56s, yellow in color, containing black hair and shorter in length because most of the sheep's energy is used to produce meat and not wool. An outstanding feature of this wool is its very high crimp. Thus, the yarn made from this type of wool would have poor color, not a very soft hand, not too good strength, but would be extremely lofty because of the high crimp. In sweaters, for example, where loft is of great importance, the very best knitting yarns of this grade are made out of wool from this type of sheep.

A yarn made from the wool of the all-purpose Corriedale sheep, even though it might be of the same quality as that made from the wool of the black-faced Hempshire, would not be as lofty but would be softer, stronger and of good white color with no black hair.

The breed of sheep alone does not completely determine the characteristics of the wool. Climatic conditions have a great deal to do with it. For example, the Corriedale raised in New Zealand produces a different type of wool from the Corriedale raised in the southern part of Chile in the section called Punta Arenas. In New Zealand, the sheep feed on lush grass pasture and become healthy and large. The wool is longer and stronger but is not quite so soft as the wool produced in Chile from the same breed of sheep. As the Corriedale in Chile grazes in a pasture that is rather sparse, it is not very well fed. The winters in the southern tip of South America are very severe. If a sheep goes without food for a few days as a result of a bad snow storm, a tender spot appears in the fiber because the sheep is in a weakened condition. The wool is very soft, however, as rigorous conditions causes a sheep to grow softer wool. Thus the wool produced by the Corriedale sheep in the Punta section of Chile is very soft, somewhat lacking in strength but of reasonably good crimp to give a lofty yarn.

Sheep that live in a hot, dry climate tend to grow a dense and fine fleece as protection from the sun, and normally the harder it has to work to get its food, the finer and softer the wool will be. For example. in this country the finest wools are produced in the southwestern corner of Texas around San Angelo. In South Africa, the Merino is the predominant breed, and the South African Merino, which grazes on very sparse land, produces a finer wool than the Australian Merino, which grazes on better pasture.

The type of soil upon which the sheep graze also helps determine the characteristics of the wool that the sheep produces. An extreme example of how this can affect the wool fiber is found in South Australia, where the land is deficient in certain trace elements, such

(Concluded on Page P444)

A COMPARISON OF PHYSICAL PROPERTIES OF LIGHTWEIGHT COTTON CORDUROYS OF DIFFERENT CONSTRUCTIONS*

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INTRODUCTION

IN A series of five studies conducted at the University of Alabama by Thompson, Wellington, Saxon, Keeney, and Petzel (*2, 3, 5, 6, 7*), lightweight cotton corduroys of four different weave structures purchased between 1945 and 1951 have been studied. Corduroys of two of these weave structures may be further classified on the basis of the presence of a relatively high or low number of filling yarns per inch. When the data from these five studies are pooled, it is possible to make comparisons on the basis of a greater number of fabrics than when the fabrics included in a single study are compared. Therefore, the purpose of this report is to compare the physical properties of 42 lightweight cotton corduroys of four weave structures (from the five studies), emphasis being placed on the probable relationships of fabric breaking strength to other physical properties.

REVIEW OF LITERATURE———The only previous study found to contain comparisons of corduroy in relation to weave structure was one made by White *(8)*, who investigated corduroys of the constructions which we have designated as types B, C, and D1 (two, four, and four examples, respectively).

EXPERIMENTAL

FABRICS———The corduroys studied were of the four weave structures shown in Figure 1. Fabrics of types A and D were further subdivided into classes A1 and D1, which had relatively low numbers of filling yarns per inch, and classes A2 and D2, which had relatively high numbers of filling yarns per inch. Because more than one-half of the corduroys were purchased from retailers, some of the 42 fabrics may have been produced by the same manufacturer as approximately the same quality of fabric. The fabrics were considered to be representative of lightweight cotton corduroys on the market.

F E Petzel

Data on 42 lightweight cotton corduroys were studied to determine the relation of fabric construction to differences in mean breaking strength and other physical properties. The constructions for which significant differences in breaking strength were found included type A1, in which filling yarns interlaced with individual warp yarns except where filling pile yarns floated over three ends; type D1, in which filling yarns interlaced with pairs of ends except where filling pile yarns floated over six ends; and type B, which was intermediate between types A1 and D1. All of these corduroys had W-type pile.

On the basis of the findings of this investigation, corduroys of the D1 construction tended to be somewhat stronger warpwise than those of the A1 construction, this difference being coupled with the greater number of warp yarns per inch and the greater twist of warp yarns in fabrics of type D1 as compared with type A1. In general, corduroys of types A1 and D1 were stronger fillingwise than those of type B, the differences in filling yarn number and thickness being associated with the differences in fillingwise breaking strength. .

Corduroys of type A construction were not significantly different in fillingwise breaking strength when made with high and low filling counts, the use of coarser filling yarns apparently compensating for a lower number of yarns per inch.

PROCEDURES———The properties studied included yarn number by the cotton system, twist, number of ribs per inch, number of yarns per inch, thickness, weight, and breaking strength by the raveled-strip method. As far as possible, procedures of the American Society for Testing Materials *(1)* were followed in the five studies on which the present report is based. However, measurements of thickness were made by means of a gauge equipped with a presser foot nine-sixteenths inch in diameter and exerting a pressure of 16 pounds per square inch. Breaking strength was determined on a machine of the constant-rate-of-traverse class. Differences among physical properties of corduroys of structural types A1, A2, B, and D1, the constructions for which data on at least two fabrics were available, were studied by means of the analysis of variance and significant differences between means *(4)*.

RESULTS

The mean warpwise breaking strength of corduroys of the D1 construction was 8 pounds, or 16 percent, greater than that of fabrics of the A1 construction (Tables I and II). On the average, fabrics of type D1 had a lower number of ribs per inch and lower weight but a higher number of warp yarns per inch, warp yarn number (finer yarns), and twist of warp yarns than fabrics of type A1 construction. Of these properties, the greater number of warp yarns per inch and greater twist of warp yarns in fabrics of type D1 were the factors which appeared most likely to be related to the greater warpwise breaking strength of this type of corduroy as compared with fabrics of type A1.

In the fillingwise direction, corduroys of type B construction were an average of 6.7 pounds, or 25 per cent, weaker than fabrics of type A1 and nearly 9.5 pounds, or 36 per cent, weaker than fabrics of type D1. On the basis of means, corduroys of types A1 and D1 were made from coarser filling yarns with lower twist, were thicker, had fewer ribs per inch, and contained fewer filling yarns per inch than fabrics of type B. Of these properties, the yarn number of filling yarns and thickness were the ones

* A contribution received by the Editor of Proceedings on April 23, 1954.
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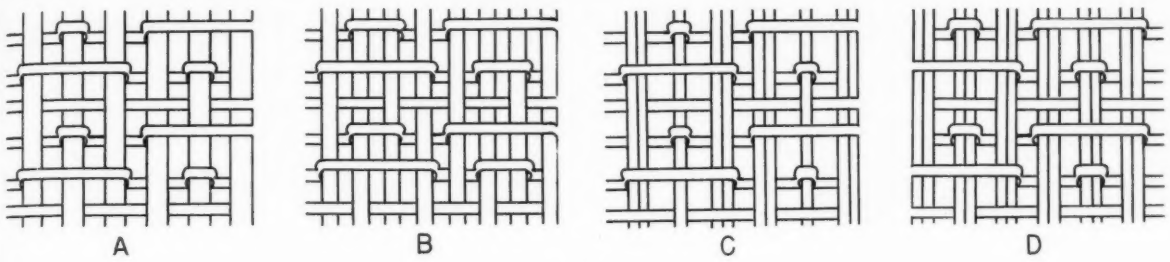

Figure 1

Weave structures of corduroy. The long floats of fillingwise yarns are cut to form the pile.

which appeared most likely to be related to the differences in fillingwise breaking strength. White *(8)* also found that corduroys with the D1 type of weave contained coarser filling yarns, were thicker, and had a lower number of ribs and filling yarns per inch than fabrics of type B.

Because only one example of construction C was studied, only a few general observations may be made concerning it. The corduroy of this construction was outstandingly high in warpwise and fillingwise breaking strength. It was made from relatively coarse yarns with comparatively low twist, had a low number of ribs per inch, had a moderate number of warp yarns per inch but a relatively low number of filling yarns per inch, and was heavy in weight. White *(8)* found type C corduroys to have coarser yarns, fewer ribs per inch, lower filling count, and greater weight than fabrics of type B.

The question also arises as to whether corduroys of a given weave structure are superior when woven with a relatively high number of filling yarns. The difference of 1.8 pounds in mean fillingwise breaking strength of fabrics of the A1 and A2 constructions was small and not statistically significant. Apparently the use of coarser filling yarns compensated for the lower number of filling yarns per inch in corduroys of type A1 construction as compared with fabrics of type A2.

Among type D1 corduroys, the use of coarser filling yarns did not compensate for a lower number of filling yarns, the one example of type D2 fabric being 4 pounds stronger in the fillingwise direction than the strongest type D1 fabric.

CONCLUSIONS

It may be concluded that corduroys of the D1 construction tended to be somewhat stronger warpwise than those of the A1 construction, this difference being coupled with the greater number of warp yarns per inch and the greater twist of warp yarns in fabrics of type D1 as compared with type A1. In general, corduroys of types A1 and D1 were stronger fillingwise than those of type B, the differences in filling yarn number and thickness being associated with the differences in fillingwise breaking strength. Corduroys of type A construction were not significantly different in fillingwise breaking strength when made with high and low filling counts, the use of coarser filling yarns apparently compensating for a lower number of yarns per inch.

Because yarn properties and fabric construction are related to the serviceability of corduroy, it is desirable that corduroy be labeled and that such labels carry information indicating probable serviceability. When such information is found, it is usually quite limited.

TABLE I

NUMBER OF CORDUROY FABRICS OF EACH CONSTRUCTION FOR EACH PROPERTY MEASURED

Construction	Yarn number		Twists per inch		Ribs per inch	Count per inch: Filling			Thickness	Weight	Breaking strength, raveled-strip method	
	Warp	Filling	Warp	Filling		Warp	Ground	Ground & pile			Warpwise	Fillingwise
A1	16	16	22	22	22	22	22	22	19	11	22	22
A2	2	2	—	2	2	2	2	2	—	2	2	2
B	3	3	3	3	3	3	3	3	2	2	3	3
C	1	1	1	1	1	1	1	1	—	1	1	1
D1	6	6	13	13	13	13	13	13	12	4	13	13
D2	1	1	1	1	1	1	1	1	1	—	1	1

TABLE II

PROPERTIES OF LIGHTWEIGHT COTTON CORDUROYS OF DIFFERENT CONSTRUCTIONS

Construction	Yarn number (Cotton system)		Twists per inch		Ribs per inch	Count per inch: Filling			Thickness	Weight	Breaking strength, raveled-strip method	
	Warp	Filling	Warp	Filling		Warp	Ground	Ground & pile			Warpwise	Fillingwise
	Number	Number	Number	Number	Number	Number	Number	Number	1/1000 inch	Oz per sq yd	Pounds	Pounds
A1	16.5	19.7	17.1	17.7	16	47.0	44.4	133.2	25.3	7.6	48.0	33.4
A2	19.8	32.8	—	20.6	16	48.2	60.8	182.4	—	6.2	47.4	35.2
B	25.7	36.1	22.4	23.4	17	62.0	59.2	177.5	19.5	6.8	53.2	26.7
C	16.3	20.8	14.0	16.2	14	68.7	47.4	142.2	—	8.6	88.9	46.3
D1	28.4	20.4	21.3	14.8	14	82.1	45.5	136.5	24.0	6.7	56.0	36.1
D2	27.0	34.0	24.0	19.0	15	85.4	62.3	186.8	22.0	—	58.3	44.6

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Yarn ——

(Concluded from Page P441)

as copper and cobalt. The sheep that graze on this land produce a wool that lacks crimp and has a very high luster. It is difficult to spin this wool as it is quite slippery. It does not have the same affinity for dyestuff as that of normally grown wool. The wool is silky and soft, however, partly because of this lack of crimp.

I mention all of this not to suggest that the buyer of worsted yarn should inquire as to the origin of the wool in the yarn which he is buying, but rather to try to illustrate the great differences in the characteristics of a wool fiber even though they might give the same result in a micron test of diameter. The yarn salesman should always try to ascertain what characteristics the customer desires in his yarn, as one type of wool will give better loftiness, another type will be the softest, another the whitest, while still another will be the strongest. You cannot get maximum softness, maximum loft, maximum strength and best color all in one yarn. For example, in one grade of 54s-quality yarn we manufacture, we sell five different blends, each to achieve a certain end result, even though the quality or the micron test is the same in all five blends.

YARN FOR HALF HOSE———I have reached the concluding remarks in my paper, and yet I have not discussed hosiery, which is, after all, the subject of this session. What characteristics are desirable in a yarn for half hose is a question that you are better able to answer than I. My experience has been in the purchasing of raw material and its manufacture into yarn. It is necessary that the buyer of spun yarn co-operate closely with the manufacturer of the yarn by telling him what he is looking for so that the half hose manufacturer gets a yarn with the characteristics he desires. The yarn manufacturer knows what factors are needed to give softness, loft, evenness, elasticity, smoothness of appearance, low cost, etc, but, as all of these are not present in one given yarn, he must know what characteristics you want most so that you get the yarn you need.

CONCLUSION

I hope this discussion has not been too confusing. A comparison of various systems of manufacturing can become extremely complicated as there are many fine points to consider. During the past six or seven years we have been purchasing new machinery, and we are well aware of how confusing a comparison of the merits of one system over the other system can be. There will naturally be exceptions to many of the statements I have made, but I have tried to summarize in as simple a manner as is practical in a discussion such as this.

DISCUSSION

Question: I would like to assume, for the sake of discussion, that it would be possible to make any kind of yarn you want with respect to either strength or softness. If, for instance, you have a short fiber and still want a low twist, could you not size the yarn after it has been spun with a normal amount of twist, and then take out the twist later? For example, could you not do this with a fine-denier nylon to produce a yarn with the properties you want? With this sort of supposition, what denier fiber would you shoot for, that is, a yarn of 20-denier fiber or a crisp yarn of 12-denier fiber?

Answer: That is up to the buyer, but usually the softest possible yarn is wanted.

Q: In other words, the finer denier would be used?

A: The finer the denier (the lower the denier number), the softer would be the yarn.

Q: In the case of fiber length, would not a six-inch staple give a very lustrous yarn because it would have fewer fibers than a yarn of shorter staple?

A: I would say luster is not dependent upon either staple length or denier.

Q: What is the ideal staple length?

A: That has been a matter of much discussion. Some people think that the American, Bradford and French systems are all heading to a common staple length, but they have not yet arrived there. Longer staple, however, can be spun with a lower twist and therefore can be spun softer.

In your first question you talked about taking the twist out of yarn. Such a procedure would be very expensive.

Q: That was only a supposition to find out what would give the best quality of yarn. Maybe a method could be found to do it cheaply.

A: The softest yarns use staple that is at least 4½" long. In the case of the American and cotton systems, the staple length of synthetics is being made longer and longer; at the same time, the tendency has been to use finer and finer fibers.

Q: What is the ideal twist?

A: That is dependent upon the type of spinning. Normally, one spins with the lowest possible twist to get softness, but if the twist is too low, excessive breakage occurs in spinning. Soft yarns are desirable for half hose.

Q: What is the relation between the twist of a single yarn to that of the two-ply yarn made from it?

A: In our plying operations we take out half the twist from the single yarn when we twist a two-ply.

Q: What uniformity in yarn construction is required for proper knitting and for good appearance in the knitted textile?

A: That depends upon several factors, but for different types of work, kinds of yarns and types of knitting machines and needles figures are available. The Anderson Machine Shop and the Pacific Mills, who sell uniformity testers, have set up charts suggesting allowable variation limits.

Q: What is being done about pilling?

A: Du Pont representatives are here; perhaps they can answer that question.

A: A lot of work is being carried out on the problem of pilling. Some synthetic fibers do pill considerably. That causes us grave concern, not because pilling affects the wear life, but rather because it mostly affects the appearance. We do not yet have a solution to the pilling problem, but we are learning about the mechanics of pilling. Turning garments, for example spun-nylon socks, inside out during washing is an excellent palliative but not a cure.

Q: Is the softness of wool yarn dependent mostly upon the fineness of the fiber?

A: Yes, but the kind of wool and the environment under which the sheep was grown are also important factors.

• PATENT DIGEST •

PAUL WENGRAF

PHOSPHORUS OXYCHLORIDE AND AMMONIA Condensed in Solvents and Used as Flame Retardants G, 2, 03

U S Pat 2,661,263
(Monsanto Chem Co——Nielsen——
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(Monsanto Chem Co——Malowan——
Dec 1, 1953)

These patents have in common the general idea of flameproofing with agents produced by the reaction of phosphorus oxychloride and ammonia, condensates which have been suggested in the past for flameproofing finishes. The innovation is the application of a newly syntheticized compound of this type available as a water-soluble solid powder, ready for use.

U S Pat 2,661,263 explains in the preamble the importance not only of preventing flaming by the application of flame retardants, such as metal oxides (Sb_2O_3 or similar oxides), but also of avoiding afterglow that frequently propagates a flame which appears to be extinguished. R W Little [cf *Am Dyestuff Reptr 37,* 116 (1948)] is quoted as stating that "the phenomenon of afterglow is an entirely different reaction, independent of the afterflaming tendency . . . there are very few glowproofing agents, etc".

The inventors have discovered that flame-retardant as well as glow-retardant effects may be imparted to cellulosic products by applying a mixture of antimony and titanium compounds with an N-P-containing product obtained by the reaction of $POCl_3$ with *anhydrous* ammonia. The ratio of Sb to Ti compounds is given as 1:1 to 2:1 mols. The water-soluble N-P-reaction product essential for this process results when phosphorus oxychloride is dissolved in a solvent, e g, hexane, and anhydrous ammonia is passed through this solution, first at temperatures not exceeding 100° C, and then at a maximum 150° C. The ammonium chloride formed is separated out by different methods. The final, pure compound has a molecular weight between 200-250 and an N:P ratio of 2:1-2:3; it is water soluble and forms an aqueous liquid of pH 7.0-8.5.

Example (#4): cotton fabric impregnated with an equimolecular mixture of antimony chloride and titanyl chloride (together in a 45% concentration calculated from the weight of the oxides) is squeezed to a pickup of 100%, neutralized in a 15% soda ash solution and then treated with a 5% solution of the aforementioned N-P-condensates. The goods are cured for 10 minutes at 150° C and then rinsed. When subjected to standard tests they show an afterglow for 9 seconds only.

The preparation of the new compound is fully described in *U S Pat 2,661,264.* It appears that the product contains closely related compounds, which probably contain the group

$$H_2N-PO(-)-NH-.$$

It is water soluble up to 70% concentration and is characterized by high reactivity (substantivity) with cellulose, as proved by washing in three cycles with a customary detergent solution. The reactivity is said to be greater than that of other nitrogen-phosphorus condensates. Separation from ammonium chloride formed in this reaction as a by-product is effected by a treatment with small amounts of water (leaching out the N-P compound only), or by a treatment with liquid ammonia or methanol (dissolving ammonium chloride only).

U S Pat 2,661,311 states that treatments of cellulose, first with phosphorus oxychloride and then with ammonia, have been described, for instance, in U S Pat 2,401,440 (see references below). The products obtained by this method contain phosphonamide groups. It is objectionable that, in this event, chemicals requiring special equipment that is generally not available in ordinary textile plants have to be applied. The condensates of the new type, however, can be handled in every mill. This patent protects the application of the aforementioned N-P-condensate on cellulose and the glow-proofed textile material resulting from this process.

U S Pat 2,661,341 protects a method for rendering phenol-aldehyde resins flame- and afterglow-retardant by combining them with the above mentioned P-N compounds.

U S Pat 2,661,342 refers to an analogous treatment of cellulosic textiles with combinations of the P-N condensates and aminoplast resins, such as urea- or melamine resins.

Among the references relative to U S Pats 2,661,263/64, 2,661,311 and 2,661,342 cited by the Patent office:

U S Pat 2,462,803 (Secy Agriculture/1949) applies to a flameproofing emulsion containing a urea-formaldehyde condensate, chlorinated paraffin and antimony oxide.

U S Pat 2,464,342 (Pollak-Fasal/1949): rendering fabrics nonflammable by impregnating with ammonium pyrophosphate and a melamine-formaldehyde condensate [cf *Am Dyestuff Reptr 38,* 478 (1949)].

U S Pat 2,482,756 (Bancroft & Co/1949) applies to a flameproofing composition comprising the reaction product of urea (dicyanodiamide, biuret) and orthophosphoric acid to which ammonia has been added.

U S Pat 2,427,997 (White/1947) applies to flameproof finish obtained by impregnating with sodium carbonate solution, drying, and finally applying antimony trichloride in an organic solvent [cf *Am Dyestuff Reptr 36,* 720 (1947)].

U S Pat 2,401,440 (Monsanto Chem Co/1946): flameproofing cellulose by reacting with phosphorylchloride and then with ammonia to produce the corresponding amide [cf *Am Dyestuff Reptr 35,* 440 (1946)].

U S Pat 2,163,085 (Du Pont/1939) applies to a flameproofing agent for cellulosic material comprising the reaction product of phosphorus pentoxide and anhydrous liquid ammonia.

Among the references to U S Pat 2,661,341:

U S Pat 2,413,163 (Du Pont/1946) applies to a flameproofing composition containing Sb, As, Bi or Sn compounds, a chlorinated, water-insoluble organic compound, and a "joint protective and dispersing agent" comprising formaldehyde, a protein and phenol or a resin-forming amine [cf *Am Dyestuff Reptr 36,* 338 (1947)].

U S Pat 2,582,181 (Hlavaty-Truhlar/1952) applies to a fireproof paint containing *a water-insoluble* reaction product of phosphorus oxychloride and anhydrous ammonia.

U S Pat 2,163,085 (Du Pont/1939): see above.

PIGMENT PRINTING EMULSIONS——— Thermoplastic Resins in Aqueous Phase D, 2, 07

U S Pat 2,663,696
(Sun Chem Corp——Armatys——Dec 22, 1953)

The advantages of printing pigments from oil-in-water or water-in-oil emulsions over the old method of simply fixing the pigment by a film-forming material are stressed in the introduction to this patent. In the new method the individual fibers are coated with a film of the binder in contrast to the older method whereby the fabric structure is completely covered with a continuous layer.

Although the hand of the fabric is improved substantially by the emulsion printing method, this method produces prints of poor resistance to crocking. According to the present specifications, elimination of this deficiency may be brought about by using specific water-in-oil emulsions. The aqueous (dispersed) phase contains a latex of a water-dispersible synthetic thermoplastic material, e g, a vinyl or vinylidene homo- or copolymer. The lacquer (continuous) phase comprises a solvent-soluble thermosetting resin, preferably a butylated melamine-formaldehyde, optionally modified by an alkyd resin and dissolved in appropriate solvents, together with some lower alcohols. The amount of pigment dispersed in this phase must not exceed the ratio of 1.5 pbw pigment to one pbw resin binder.

It is of particular importance to add plasticizers in amounts of 5-12% to these compositions; they might be a component of the oily phase, or dispersed in the aqueous phase.

Example: the aqueous phase consists of 10% of a 65% concentrated polyvinylchloride latex, while the lacquer phase consists of butylated melamine-formaldehyde resin in butanol-turpentine-amylalcohol plus a phthalocyanine blue pigment (together 79%) and 11% tricresylphosphate as a plasticizer. The printed goods are heated to 300-350° F to evaporate the solvent and at the same time to set the resin contained in the continuous phase.

The improved crockfastness imparted is probably due to the better binding properties of the composition. The inventor assumes that the thermoplastic material is deposited upon the fabric in the form of finely divided particles interspersed throughout the thermosetting condensate; possibly the flow of these particles is attributable to the softening action of the plasticizer and the formation of a protective film to cover the pigment particles and the thermosetting binder.

References cited by the Patent Office:

U S Pat 2,511,171 (B B Chemical/1950) refers to an adhesive for flock printing comprising a dispersion of synthetic and natural latex in a nonaqueous solution of oil-modified alkyd resins.

U S Pat 2,431,078 (Carbide & Carbon Chem/1947) refers to a stable suspension of a toluene-insoluble vinyl resin dissolved in a mixture of aliphatic and aromatic hydrocarbons.

U S Pat 2,361,454 (Interchem Corp/1944) refers to a water-in-oil printing emulsion of the "Aridye" type, the inner (aqueous) phase of which is thickened with an autodispersible substance such as starch or alginic gum, or with compounds capable of forming insoluble resins, such as urea-formaldehyde, in further processing.

SHRINKPROOFING WOOL ———Acid Colloidal Solutions of Methylated Methylolmelamines Used A, 2, 04

U S Pat 2,661,313
(Monsanto Chemical Co——Folkers——Dec 1, 1953)

The preamble to this patent states that the shrink- or feltproofing of woolen fabrics with a mildly neutral or alkaline solution of melamine-formaldehyde condensates, followed by heat curing, has been advocated in the past. Furthermore, highly concentrated acid solutions of partially polymerized melamine-formaldehyde, developed by subsequent heating, have been suggested for the same purpose. The inventor objects to the fact that these processes require a deposit of 8-25% of the condensates, causing an undesirable hand and involving higher production costs.

The present patent advocates the use of *dilute* acidic aqueous colloidal solutions of a partially polymerized *methylated methylolmelamine.* The concentration of this solution and the degree of extraction in padding have to be adjusted to a deposit of 3.5-8% resin on the fabric's weight. The solutions are prepared by dissolving a water-soluble methylated methylolmelamine at a pH 7-11 and acidifying with acetic, hydroxyacetic or formic acid. Satisfactory colloidal solutions are formed, for instance, when 6-8.5% by weight of acetic or hydroxyacetic acids or 1.2-3% formic acid calculated on a 10% solution of the condensate are used. This solution is aged until the characteristics of a colloidal solution (blue haze, Tyndall effect) appear. The aging time differs according to the temperature: more than 6 hours for temperatures of 40-70° F, within 4 hours at 70-90° F, and within 3 hours at 100-200° F. The viscosity of an appropriate (10%) solution is listed as 3-5 centipoises. It is reportedly stable for 72-168 hours, becoming unfit for use only upon attaining a viscosity of about 15 centipoises, after which it gels quickly.

Positively charged colloidal solutions of this type are substantive to the negatively charged cotton fibers, but nonsubstantive to wool. Examples in the specifications give full details for preparing the alkaline aqueous solutions of the methylated methylolamine condensates and for transforming them into acidic aqueous colloidal solutions. The latter are diluted with water to contain 6% of the condensate. An all-wool fabric padded with this solution and squeezed to a pick-up of 70% was dried for 10 minutes at 200° F, then heated for 10 minutes to 250° F, rinsed and scoured. No yellowing nor tendering of the fibers was observed, and the fabric retained its soft touch. A total shrinkage of 8.0% (warp) and 1.0% (filling) of the treated fabric is reported against corresponding figures of 22.1 and 16.0% for the untreated material.

References cited by the Patent Office:

U S Pat 2,485,080 (Am cyanamid/1949): preparing aqueous colloidal solutions of a resinous copolymer of melamine, urea and formaldehyde, acidified to a pH range of 3-4 with acetic acid, for use especially in the treatment of textiles, as bonding substances, etc.

U S Pat 2,429,073 (Hat Corp of America/1947): conditioning fur fibers for felting by a treatment with an acid solution of melamine-formaldehyde.

U S Pat 2,417,014 (Am Cyanamid/1947): an aqueous polyhydric alcohol solution of an acidic colloidal, partially polymerized melamine-formaldehyde condensate is used for improving the wet strength of paper, for coating, bonding and hydrophobing fibers, and so on.

U S Pat 2,395,791 (Cluett Peabody/1946): shrinkproofing wool by treating with alcoholic caustic and thereafter with a resin-forming dispersion. Both treatments in themselves are insufficient to produce a satisfactory effect [cf *Am Dyestuff Reptr 35,* 336 (1946)].

U S Pat 2,345,543 (Am Cyanamid——Wohnsiedler/1944): preparing a colloidal, partially polymerized, positively charged aqueous melamine-formaldehyde condensate solution (cf U S P 2,485,080 above).

U S P 2,191,362 (Ciba/1940): treating textiles with hardenable melamine-formaldehyde condensates in general.

Reference may further be made to two recently granted U S Patents, abstracts of which were published after the application date of the current patent. U S Pat 2,654,715 (Am Cyanamid/1953) [cf *Am Dyestuff Reptr 43,* 344 (1954)] refers to the use of similar acidic colloidal solutions in animalizing viscose; and, U S Pat 2,632,717 (Ciba/1953) [cf *Am Dyestuff Reptr 43,* 150 (1954)] protects a method for shrinkproofing with colloidal acid solutions of hydrophobic melamine resins. [See also the Intersectional Contest Paper of the Rhode Island Section, AATCC in *Am Dyestuff Reptr 38,* P722 (1949)].

• ABSTRACTS •

Resistance to Microbiological Deterioration of Resin-treated Cellulosic Fabrics

T F Cooke, *Textile Research J* 24, 197-209, March, 1954.

It has been found that textile resins of the water-soluble, aminoplast type will prevent the microbiological deterioration of cellulosic fibers.

In order to have a better understanding of this subject, the following points are discussed in this paper:

(1) The physical and chemical structure of cellulosic fibers.
(2) The types of microorganisms that attack cellulose, and the mechanism by which the cellulose fiber is deteriorated.
(3) The fungicides and bactericides normally used to prevent microbiological deterioration of cellulose.
(4) Some chemical reactions with cellulose that alter its resistance to microbial decomposition (e g, acetylation, cyanoethylation, and phosphorylation).

Then the effect of textile resins on a) the properties of cellulosic fabrics and b) the microbiological deterioration of fabrics is discussed.

Summarizing, the author shows that the thermosetting, aminoplast textile resins provide excellent resistance to the cellulolytic microorganisms. Melamine- and urea-formaldehyde resin-treated cotton fabrics have withstood exposure to six weeks in a very potent soil-burial bed with no loss in tensile strength. The resin treatments have the advantages over the normally used toxic inhibitors of being completely resistant to leaching and nondermatitic to human beings. Durable water-repellent and fire-resistant treatments can be incorporated with these resins to provide these properties in addition to resistance to microbiological deterioration. If control of the growth of noncellulolytic organisms is also desired, fungicides and bactericides may be added, but smaller amounts than normally used are required.

It is suggested that the role of the urea- and melamine-formaldehyde resins in preventing the microbiological deterioration of cellulosic fabrics is to chemically react with the cellulose. It is possible that this reaction occurs between the cellulose and the resin by the formation of an ether. Dimethylol urea may form a diether and trimethylolmelamine a triether with adjacent cellulose molecules. In this way cross-linking between cellulose chains may occur.

Fifty references to the literature are cited.—WHC

Properties and Uses of Courlene

Anon, *Textile Mercury & Argus* 130, 595-6, April 2, 1954.

Courlene, Courtaulds' new synthetic yarn, is being successfully used, according to the author, for a variety of industrial purposes and to achieve novelty shrinkage effects in ordinary textile cloths.

Produced from polythene, and chemically related to the paraffins, Courlene is a monofil or multifilament yarn which is tough, flexible, and thermoplastic. Exceptionally inert, it resists attack by most chemicals at normal temperatures, does not absorb moisture, and is unaffected by insects and bacteria. It can be processed, woven, knitted, and finished on standard textile machinery. Monofils are now in commercial production, but at present multifilament yarns are available only for development work. Courlene has a pliable handle and feels slightly "waxy".

The monofil is produced in diameters from 5 to 20 thousandths of an inch. A typical example of multifilament is a 300 denier (28 filaments). Colored yarns are produced by pigmentation, and colors (in monofil only) are clear, black and white (pigmented), opaque colors, including red, blue, green, yellow, orange, purple, and brown, and translucent colors.

The low specific gravity of Courlene means that it can float on water. It has reasonably good elastic recovery and abrasion resistance, and it does not wet or absorb moisture, so that wetting at normal temperatures does not affect its properties. It softens above 90° C and melts between 110° and 120° C. At above room temperature and up to its softening point, yarns show increasing shrinkage, and if allowance is made for this, a cloth stable to 60° to 70° C can be produced by suitable finishing. The fiber has good resistance to weathering, but light eventually degrades it.

Among some of the uses of Courlene listed are as upholstery fabrics in cars and chair seats; for towing targets by aircraft; and to give seersucker or blister-type effects in ordinary textile cloths, where such cloths are not ironed; trials have been satisfactory for dresses, cushion covers, and bedspreads.

Courlene has been found suitable for protective clothing, such as overalls. It is particularly suitable as a fusing thread in interlining cloths, and a cotton-Courlene interlining is being used for semistiff collars. It is also being developed for bonded collars for nylon and other synthetic fiber shirts, which has not been commercially possible before. Courlene is also suitable for insulation work, and for ropes and filtration cloths.—WHC

Abrasion Damage of Textile Fibers

G Susich, *Textile Research J* 24, 210-28, March, 1954.

When textiles in contact with solid bodies are moved relative to each other, rubbing-off or abrasion occurs. The purpose of this study was to investigate quantitatively the abrasion behavior of various textile materials. Fourteen different textile fibers, in the form of yarns, were tested.

Abrasion damage was measured quantitatively by the fiber fineness (grex) destroyed in flexing around a steel bar under standardized conditions, using the Stoll-Quartermaster abrasion tester. The abrasion damages were evaluated relative to that of high-tenacity nylon multifilaments.

Great differences exist in the abrasion behavior of the various fibers. The damage of multifilaments increases from nylon to Dacron, viscose, Fortisan, Orlon, Saran, silk, acetate, and casein, while that of staple yarns increases from nylon to Dacron, cotton, Fibravyl, Dynel, Kuralon, Thermovyl, wool, Orlon, viscose, and acetate. Staple yarns were always more abraded than corresponding multifilaments.

Although high elastic energy of fibers is the main factor preventing inherent abrasion damage, extensibility, yarn surface, and friction must also be taken into account in interpreting the abrasion behavior of various textile fibers.

Full details are given of the experimental work involved, and the results are presented in tabular form. The author also reviews briefly the work of previous investigators in measuring both yarn and fabric abrasion.

Eighteen references to the literature are cited.—WHC

Opportunity for Ramie

Anon (from a Brazilian Bulletin), *Dyer* 111, 347, March 5, 1954.

Of all vegetable fibers, *Boehmeria nivea*, China grass, or ramie (as it is more commonly known) is perhaps the most versatile, yet certainly the least known to the general public. During the air bombardments of London early in the last war some of the remarkable qualities of ramie were observed. Firemen were using hoses that resisted very high pressures while taking the hardest of usage; they were made of this fiber because of its great powers of resistance, especially when wet. In addition, ramie was being used for a

large range of products highly necessary in wartime.

The difficulty about ramie has always lain in the considerable manual labor required in separating fiber from bark (decortication), and then in cleansing the fiber of resinous gums in which it is embedded (degumming). It is now reported that production difficulties have at last been solved with the invention of a special combine, manufactured in the U S. The combine deleafs, cuts and decorticates in one operation, bundles the fiber and casts it out. It can be operated by one man and harvests from one to 1¼ acres per hour.

When thoroughly cleansed of gums and pectins, the fiber is pure white in color and has an almost silk-like luster and texture; it is said to be fresher and more absorbent than linen and just as soft; it needs no bleaching; in elasticity it equals cotton, is more absorbent, and has high immunity to shrinkage, mildew and abrasion; it does not stretch; it does not discolor and takes dyes well and retains them. Ramie goods, it is asserted, can be washed more easily than any other textiles, and the most tenacious stains removed. The tensile strength is greater than that of other fibers, and when wet, increases by 30 to 40 percent. Its durability has been adequately tested by the Egyptian mummies wrapped in it 4,000 years ago.

Renewed interest in ramie is now spreading fast among Brazilian spinners. They are planning to expand both production and equipment with the idea of providing a substitute for linen in the Brazilian market.—WHC

The Production and Properties of Solution-Dyed Acetate

P F Flamm, *Textile Research J* 24, 357-61, April, 1954.

This is a description of the "Chromspun" yarn and staple made by the Tennessee Eastman Company.

Solution-dyed acetate is dry-spun from solutions containing highly dispersed coloring agents. The coloring agent is dispersed uniformly throughout each filament, whereas by standard dyeing techniques the coloring agent is confined to the surface.

Proper dispersion of the dye is highly important. Poor dispersion lowers the color efficiency and impairs the physical properties of the yarn.

Uniformity in colors is achieved by controlling filament denier, homogeneity of the spinning solution, and ratio of coloring agent to acetate. Other factors which influence color uniformity are luster, twist, finish, stretching, and the geometric spacing in the fabric. The color is judged by instrumentation and by visual means.

Coloring agents are selected on the basis of their optical, physical, and chemical properties. They must be stable under the conditions encountered by the fabric in service and in cleaning.

Chromspun yarn is stated to have excellent fastness to sunlight, washing, atmospheric fumes, perspiration, crocking and drycleaning. It also withstands other fading hazards such as salt water and the chlorine in swimming pools. It is slow to soil, easy to clean, quick to dry, and immune to moths and mildew. It also sheds wrinkles easily, resists shrinking, and has unexcelled draping qualities.

The tenacity and elongation of solution-dyed acetate yarn, in general, are slightly below the accepted values for bright acetate yarn. As a rule, the lighter the color the stronger the yarn.

The sticking point and melting point of solution-dyed acetate are 400° and 500° F, respectively.

The all-around fastness properties of the solution-dyed fiber give it much wider application than conventionally dyed acetate.—WHC

Studies in the Printing of Terylene Polyester Fiber

A G H Michie, *J Soc Dyers Colourists* 70, 13-15, January, 1954.

The experimental work which has been carried out on the printing of Terylene fiber (equivalent to Dacron) has resulted in application techniques being developed for the following types of dye:

(1) Disperse (acetate) dyes
(2) Alcian Blue 8G
(3) Vat dyes
(4) Pigments, using pigment printing compositions.

All the other known dye types have been examined, but none is of interest for application to Terylene, owing to lack of affinity or inferior fastness properties. Thus, acetate dyes containing solubilizing groups, acid, direct, sulfur, and basic dyes have little affinity for the fiber. Azoic dyes are not suitable for printing because practically all the recommended bases are too volatile in steam. Mordant dyes are not of interest because it has not been found possible to introduce metallic salts into Terylene.

It was found that the dominant factor in the coloration of this fiber was the very slow rate at which dyes diffuse into the fiber. From the dye-users' viewpoint, this means that the conditions of application must be adjusted in such a manner that the diffusion of the dye into the fiber is facilitated to the maximum possible extent.

Considering steaming conditions, therefore, it has been established that even with the most readily applied disperse dyes prolonged steaming is necessary under atmospheric pressure conditions in order that acceptable depths of shade may be realized. By utilizing the higher temperatures available when steaming is carried out under superatmospheric pressure conditions, the rate of dye diffusion is markedly increased, and it is possible to use progressively decreasing steaming times as the pressure is raised. In addition, certain types of dyes, such as the vat dyes, which yield only the palest of shades under normal steaming conditions, may be successfully applied by steaming at pressures of 20-40 lbs/sq in.

As an alternative to steaming under pressure the use of swelling agents has been examined. The most effective agent under printing conditions is stated to be *p*-hydroxydiphenyl. The effect of swelling agents is greatest under atmospheric pressure steaming conditions, and as the pressure is raised the advantage gained from their employment decreases.

Intensive efforts have been directed towards the application of vat dyes to Terylene by printing techniques. The preliminary experiments indicate that the alkaline leuco form or the unreduced dye had very little affinity for the fiber, and that the most promising method of application involved the use of the acid leuco compound. This method is briefly described, also a modification of the pad-steam method. The writer comments, however, that the lightfastness of practically all the vat dyes on Terylene is much lower than on cotton.

A few hints on the screen-printing of Terylene fabrics are added.—WHC

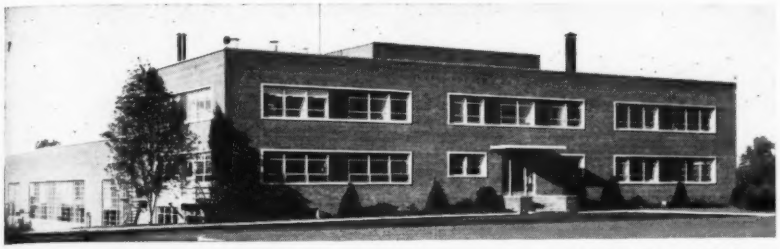
Dyeing of Nylon Yarn in Package Form

W S Willson, *J Soc Dyers Colourists* 70, 22-4, January, 1954.

A method of dyeing continuous-filament nylon yarn in cake form has been developed and proved on a bulk scale. The yarn is wound in the form of "mock" cakes on a converted coning machine, and dyeing is carried out on standard package-dyeing machinery. The use of various classes of dye is discussed, and suitable technique and aftertreatment are described.

Those who are interested in dyeing nylon yarn on packages are urged to read the entire article.—WHC

• NEWS OF THE TRADE •



Scientific experiments in the field of fermentation carried on in the Fleischmann Laboratories (above) have helped Standard Brands Incorporated develop the modern desizing agents now extensively used in the textile industry. Diastafor research will continue in this new building, which is located at Stamford, Conn.

• Standard Brands Consolidates Lab Facilities at Stamford

The new Fleischmann Laboratories, which have been established by Standard Brands Inc in Stamford, Connecticut, bring together under a single roof the major scientific resources of the Company and consolidate facilities formerly located in a number of different buildings in New York and elsewhere.

In describing to trade editors the function of the new laboratories, Albert R Fleischmann, SBI vice president, pointed out the role of research in the development of all Standard Brand products. William Johnston, director of the new laboratories and vice president in charge of research for Standard Brands, described the function and organization of the research unit and introduced his staff to visiting writers.

The laboratory units themselves are organized into eight subdivisions. In addition to a commercial bakery division where there are divisions devoted to cereal chemistry, fermentation, product service, and biochemistry; there is an organic chemistry unit and one for bio-organic chemistry, and there is a pilot plant known as the process development division. In one laboratory, 'field quality control' work is done to be sure that the quality of Standard Brands products remain uniformly high even after these products have left the manufacturer's hands and been distributed.

• Avisco Expands College Program

Continuing to expand its interest in educational grants, American Viscose Corporation will include 29 institutions in its college relations program for the academic year 1954-55. This is an increase of seven over last year's list of colleges and universities receiving fellowships, scholarships and grants-in-aid. The funds available under the program for 1954-55 will approximate $55,000.

• 102 Degrees Awarded at 56th LTI Commencement

James R Killian, president of the Massachusetts Institute of Technology, in delivering the principal address at the fifty-sixth commencement exercises of the Lowell Technological Institute on June 7, declared that "the trend toward technological complexity in American industry may be highly favorable to New England if New England can really mobilize its wealth of human resources—in short, utilizing to the fullest its resources of *Intelligence, Ingenuity* and *Imagination*".

Dr Killian spoke before a large audience which included a graduating class of 12 Master of Science Degree candidates and 87 Bachelor of Science candidates.

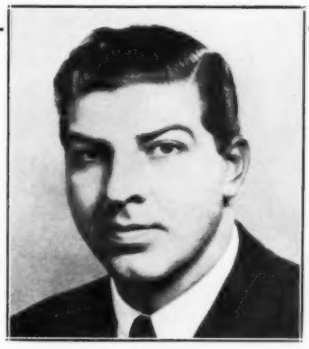
The Institute also awarded Honorary Doctor of Science Degrees to Dr Killian; Kenneth R Fox, former president of LTI and current vice president of Fabric Research Laboratories; and LTI president Martin J Lydon.

The Baccalaureate Address on the previous day was delivered by Frank Goldman, former national president of B'nai B'rith, on the subject "Brotherhood".

Alan C Cate, who was graduated with highest honors, was awarded the President's Key. Among other awards was the AATCC book prize to Armand L Greenhall.

According to LTI placement director James W Bell, the average monthly salary for graduating seniors accepting positions in industry is $368 per month, which represents a 13% increase over the average monthly salary for last year's class. Sixty-five companies made 936 contact-interviews with members of the 1954 class, representing an average of 14 interviews per student for a possible 200 job openings.

A poll of the graduating class indicates that 20% will receive ROTC commissions, 36% will be eligible for the draft, 18% will go to graduate schools, 23% will go into industry, and 3% are foreign students.



E G Walker

ERWIN G WALKER has been appointed sales manager of the Dyestuff Department of American Cyanamid Company in Bound Brook, N J, according to an announcement by James L Naylor, Department manager. Mr Walker, whose appointment to the newly created post became effective July 1, will make his headquarters at Bound Brook.

A graduate of the University of North Carolina, Mr Walker joined Cyanamid in 1933 as a salesman of dyestuffs with the former Calco Chemical Division, and he has devoted his time to selling in the South. He is a member of AATCC, president and a director of the Merchants and Manufacturers Club of Greensboro, N C, and Delta Kappa Epsilon fraternity.

PAUL LINDLEY and WALTER HARRISON, both of Cyanamid's Dyestuff Department, will take over the territory previously covered by Mr Walker.

• Ninol Building Operations Progressing

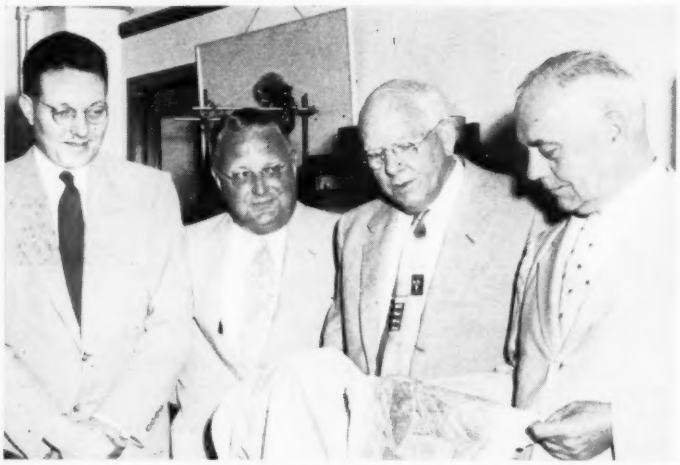
Ninol Laboratories, Chicago, have announced the completion of the first phase of their current building operations with full-scale production of salt-free sulfonates now under way at its new southside plant.

Incorporating the latest developments in process design, this plant is one of the first in the country to produce specialty sulfonates from liquid sulfur trioxide—a process on which the firm has carried out extensive pioneering work over the past few years.

Future plans include erection of additional manufacturing facilities and a modern laboratory and office building on the ten-acre site.

Founded in 1936, Ninol Laboratories was the original producer of the alkylolamide or "amine condensate" type of detergent, on which it holds the basic patents.

Collaborators at USDA Southern Utilization Research Branch ——



Collaborators to the Cotton Chemical Processing Section of the USDA Southern Utilization Research Branch met recently in New Orleans to hear progress reports on different lines of research to improve the chemical processing of cotton and to make suggestions to increase effectiveness of the work. At right, H Y Jennings, Dan River Mills, Inc, holds a scorched untreated cotton cover which has been used on a laundry pressing machine. C F Goldthwait, head of the Cotton Chemical Processing Section, holds an acetylated cover which has been used five times as long and is still unscorched. T F Cooke (left), American Cyanamid Company, and Carl J Malm, Eastman Kodak Company, look on.

Mary L Rollins demonstrates to the collaborators of the Cotton Fiber Section of the USDA Southern Utilization Research Branch, the preparation of thin sections of cotton fiber to be photographed with the electron microscope. The collaborators are (l to r): E I Valko, Onyx Oil and Chemical Co; Charles W Hock, Hercules Powder Co; and Wayne A Sisson, American Viscose Corp. Miss Rollins is in charge of the Cotton Fiber Section's Microscopical Unit.

• PTI Graduates 89 at 71st Commencement

Seventy-eight Bachelor of Science Degrees and eleven diplomas for Technology of Textiles were awarded at the seventy-first commencement exercises of the Philadelphia Textile Institute on June 12th, with Honorary Doctor of Science Degrees going to Elsie M Murphy, president of S Stroock & Co, Inc, and Harry Riemer, editor of *Daily News Record*.

Mrs Murphy, as the featured speaker at the exercises, called for greater individuality in the business world, describing the textile industry as a "fertile field" for creative effort.

Richard S Cox, PTI dean emeritus, and John Naab, professor emeritus of knitting were presented with certificates honoring their appointment to emeritus status; and commemorative medallions honoring seventy-five alumni who have been graduated fifty years or more were also announced. Fifteen of the honored alumni were present to receive the awards.

All degrees and diplomas were conferred by Rinaldo A Lukens, PTI president. Mrs George Cavendish awarded the Sarah Tyler Wister prizes to students of highest academic standing. The AATCC award for proficiency in chemistry, dyeing and printing (senior year) went to Edmund Zavaglia of Clifton, N J.

Richard Fields, president of the class of 1954, made the presentation of the class gift, a public address system, to the Institute. The gift was in use for the commencement exercises.

• Construction Begun on New Finetex Plant

East Paterson, N J is the site of a 2-story building now in construction for Finetex Incorporated, Pompton Plains, N J manufacturers of synthetic detergents, sulfonated products and auxiliary chemicals.

With operations scheduled to begin on October 1st, the new plant has been designed for large scale production of synthetic detergents, and will include a modern, completely equipped laboratory to meet the need for expanded research and product development.

• Fabric Finishing Discussed on TV

"What finishing means to the homemaker" was the topic of a recent discussion when June Evans, public relations director of Bradford Dyeing Association, U S A, and Walter R Howell, Jr, of the same firm, were guests on a Philadelphia-originated TV show. Miss Evans and Mr Howell discussed crease-resistance, shrinkage control, water-repellency, and vat dyeing, explaining the importance of each to the more than 100,000 viewers of "Homemaker's Notebook," telecast over station WCAU-TV.

• New Process for Manufacture of H_2O_2

A new process for the manufacture of hydrogen peroxide has been developed by Solvay Process Division, Allied Chemical & Dye Corporation, as a result of work initiated by Allied Chemical's Central Research Laboratory at Morristown, N J, and perfected on pilot plant scale by a team of chemists and engineers at Solvay's research center in Syracuse.

In contrast with the older electrolytic method of producing hydrogen peroxide, Solvay's new process involves a chemical oxidation reaction using raw materials mainly available within the Allied organization.

Engineering and design work for a new plant employing this process is being carried on by Solvay's own force, with the view of getting the plant into production as rapidly as possible. The new plant will be installed at one of Solvay's present locations. Decision as to its location will be made in the near future.

• Cyanamid Dedicates Fortier Plant

American Cyanamid Company dedicated its new Fortier plant near New Orleans on June 11th, bringing the Company for the first time into the production of industrial chemicals from natural gas.

Dedication ceremonies were attended by state, local and company officials. The Hon Robert A Ainsworth, Jr, president pro tempore of the Louisiana state senate, delivered the main address at a dinner held at the Roosevelt Hotel in New Orleans on June 10th.

Construction of the Fortier Plant was begun in the early summer of 1952. Production units currently in operation include sufuric acid, oxygen and ammonium sulfate. The acetylene, hydrocyanic acid, ammonia and acrylonitrile units are expected to go on stream shortly.

Chemical Construction Corporation, a unit of American Cyanamid Company, designed and built the plant.

• TTFC Expecting Large Registration at Fall Seminar

Advance registration for the Fourth Canadian Textile Seminar at Queen's University, Kingston, Ont, is proceeding in an encouraging manner, it is reported by the Textile Technical Federation of Canada.

The Federation, which sponsors the biennial seminars in the interests of expansion of knowledge of the textile sciences, is aiming at a registration total of about 400 when the three-day seminar opens September 9. One-quarter of the registration to date has been from outside Canada.

Five employees of the Nopco Chemical Co, Harrison, N J, were awarded solid gold watches by T A Printon, president and chairman of the board, at a recent ceremony commemorating their 25th anniversaries with the firm.

They are (left to right): George R Zust, Helen W Silver, Bernard A Dombrow, (Mr Printon), William Sramek, and Francis J Licata.

• RMC to Handle Armour Fatty Acid Derivatives

The Chemical Division of Armour and Company has appointed Raw Materials Company, 140 Federal Street, Boston, as sales representative for its fatty acid derivatives in New England.

For the past four years, Raw Materials has been the sales agent for Armour's fatty acid line in the area and the fatty acid derivatives will be in addition to those already handled.

Plans call for establishing stocks of these high-molecular-weight aliphatic chemicals in Boston.

• BEC Acquires Station Wagons for Southern Service

A new facility to better serve Brush Electronics Company customers in the South is the recent acquisition of four new station wagons, which will operate from the Brush Southeastern Textile Instrument Sales and Service Office at 91 Cleveland St, Greenville, S C. Using the new vehicles, Brush representatives can now give area customers 24-hour service on routine repairs. "Loaner" units can also be carried by these servicemen.

The recently established Greenville office is under the direction of D M Gaskill, supervisor, Textile Section. It sells and services the uniformity analyzer, automatic evaluator, and two new instruments—the tension analyzer and the imperfection counter.

• National Starch Aid-to-Education Program

As part of their "aid-to-education" program, National Starch Products Inc has made arrangements to establish undergraduate scholarships of $2000 each at six colleges and universities. To aid the privately financed schools in defraying the administration of each scholarship, the company is also awarding an additional sum annually to the Chemistry Department of the schools concerned.

Additional grants in the future will be awarded to meritorious graduates of local secondary schools where National Starch plants are located.

• $25,000 Library Presented to N C State

In exercises held on May 28th in the Nelson Textile Building of the North Carolina State College School of Textiles, a modern, air-conditioned library containing over 4,500 volumes was formally presented by the Burlington Mills Foundation.

Valued at $25,000 the new library is dedicated to the memory of four School of Textiles alumni who left positions with Burlington Mills for military service in World War II and lost their lives. A permanent bronze memorial tablet honors Albert R Lambert, Peter Ihrie, Jr, Wallace W Riddick, Jr, and Thomas C Leake III.

J C Cowan, Jr, president of Burlington Mills Corp, made the formal presentation to the college, and Carey H Bostian, NCSC chancellor, accepted on its behalf. Malcolm E Campbell, dean of the School of Textiles presided over the exercises.

• Celanese Award Winner Announced

Due to the high quality of entries submitted in the first annual competition among textile school students for the Celanese Award for Fabric Creation, two grand prizes have been granted instead of the one originally proposed. The award was established by Celanese Corp of America for the purpose of developing American textile designing talent and increasing the volume of new fabrics for commercial production.

Winners of the grand prize of an all-expenses paid three-day visit to New York's textile market are Boris Zighelboim of the Philadelphia Textile Institute, and James W Shuttleworth, Jr, of the New Bedford Institute of Textiles and Technology, in collaboration with Joan L Gadbois of the same school. In addition, the winners received $250 cash awards for submitting the best entries from their respective schools.

TECHNICAL LITERATURE

(This is an alphabetical list of some of the outstanding technical literature which has appeared recently. Unless otherwise indicated any literature appearing in this listing may be obtained free of charge from the supplier upon written request.)

ACRYLONITRILE ——— *Technical Bulletin F-8381, Carbide and Carbon Chemicals Co, 30 E 42nd St, New York 17, N Y* ——— The reactions of acrylonitrile and its major uses are described in this 8 page bulletin. Properties, constant-boiling mixtures, specifications, and shipping data are included.

AERO DICYANDIAMINE AND ITS APPLICATIONS ——— *Manufacturers Chemicals Dept, American Cyanamid Co, 30 Rockefeller Plaza, New York 20, N Y*———physical and chemical properties of this important product in the synthesis of organic chemicals are included in this 8-page booklet.

AEROSOL SURFACE-ACTIVE AGENTS——— *Manufacturers Chemical Dept, American Cyanamid Co, 30 Rockefeller Plaza, New York, N Y*———This 44-page booklet outlines the latest information on the many industrial applications of Aerosol surface-active agents, and also contains a discussion of surface chemistry, facts about grades currently available, and toxicity data.

ANALYSIS PROCEDURES FOR HYDROGEN PEROXIDE ——— *Bulletin No. 59, Buffalo Electro-Chemical Co, Station B, Buffalo 7, N Y* ———A critical summary of the most useful methods of assaying hydrogen peroxide solutions at all concentrations and under almost every conceivable condition is presented.

BIRCH BROTHERS, INC CIRCULARS ——— *Birch Brothers Inc, Somerville Machine Works, 32 Kent St, Somerville 43, Mass*———The following circulars are now available:

No. 1153 describes the Company's "Supreme" butt-seam sewing machine. Customers report that they make 140-200 seams per hour using this production machine.

No. 1166 illustrates the Company's wide squeeze roll unit of 15-ton capacity. This unit is made in widths up to 20', and the wider widths are used on tufted cotton carpeting.

No. 1176 covers the Company's patented stainless steel electrically controlled conical opener or spreader and guider for use in dye kettles, continuous dyeing machines, and ahead of squeeze rolls where cloth is processed in the open width. These machines come in widths from 50" to 240", the width being used on cotton carpets.

No. 1180 illustrates and describes a machine for saturating and treating cotton-tufted carpeting.

BLEACHING NYLON TYPE 670 WITH PERACETIC ACID ——— *Bulletin No. 60, Buffalo Electro-Chemical Co, Inc, Station B, Buffalo 7, N Y* ——— Bleach bath formula, make-up, and procedure for cold bleaching, jig bleaching, and knit goods bleaching of type 670 nylon, as well as type 200, using Becco peracetic acid 40%, are explained in detail.

CONTINUOUS PEROXIDE BLEACHING RANGES ——— *Catalog No. 103, Rodney Hunt Machine Co, Dept N, Orange, Mass* ——— Conventional rope and open-width bleaching ranges for larger operations and the new bleaching Rangettes for small operations are the subject of this 28-page catalog. Fully described by text, photos, and drawings is Rodney Hunt's complete line of stainless steel equipment from grey room to white bin as well as elements of the equipment which can be incorporated in other bleaching ranges for improved efficiency.

A comparison of continuous peroxide bleaching and kier bleaching is presented, showing how continuous processing can save water, steam, time, space, chemicals, and labor in addition to improving product and control.

Specifications of Becco and Du Pont-type Rangette J Boxes, Rangette Tensitrol rope washers, and Rangette saturators are given in detail.

Typical single, two and three-stage Rangette and conventional bleaching range layouts are illustrated in floor plans and schematic elevations. Photos of installations in various mills are liberally used throughout the catalog.

NEO-FAT* 18-54 ——— *Armour Chemical Div, 1355 West 31st St, Chicago 9, Ill*——— This 8-page folder describes in detail this double-pressed-type stearic acid, pointing out how its outstanding stability can help keep end products fresh longer and increase sales appeal at the point of sale.

* Trade mark

RADIAMATIC PYROMETERS COMPENSATED RADIATION DETECTOR ——— *Catalog 9301, William A Lang, Product Editor, Minneapolis-Honeywell Regulator Co, Industrial Division, Wayne and Windrim Avenues, Philadelphia 44, Pa*———Catalog 9301 covers the four types of Radiamatic radiation detectors for measuring temperatures from 125 to 7000°F. General specifications are included for the general purpose, the small target, the miniature, and the low-range Radiamatic radiation detectors, their accessories, and ElectroniK instruments and millivoltmeter pyrometers for use with these radiation detectors. The catalog also contains several typical applications of this equipment.

RODNEY HUNT TEXTILE WET FINISHING MACHINERY ——— *Bulletin No. 44, Rodney Hunt Machine Co, Dept TM, Orange, Mass*——— an 8-page illustrated bulletin covering the Company's current line.

STANDARDS IN A CHANGING WORLD——— *American Standards Association Inc, 70 E 45th St, New York 17, N Y; $3.00*———This 74-page book tells how companies use standards to increase production, cut costs, improve the quality of their product, and protect employees.

THE AMERICAN STANDARDS PRICE LIST ———*American Standards Association Inc, 70 E 45th St, New York 17, N Y*———an improved, easier-to-read format, features the index of titles.

THE ANALYSIS OF ALKALIES———*Technical and Engineering Service Bulletin No. 9, Advertising and Sales Promotion Department, Solvay Process Div, Allied Chemical & Dye Corp, 61 Broadway, New York 6, N Y*———Solvay reports that in this fourth edition the scope and arrangement of the previous editions have been retained, but many new and up-to-date additions have been made. The analytical factors have been recalculated to the basis of the 1952 International Weights. New colormetric methods for iron and nickel, and procedures for the analysis of caustic soda-sodium nitrite compounds have been included.

Other new additions include: new methods for trace metals; new methods for iron determinations; and a new method for determination of sodium nitrite. The new reagents and standard solutions necessary to accomplish the determinations by the new methods have also been added.

THE ANALYSIS OF LIQUID CHLORINE AND BLEACH———Technical and Engineering Service *Bulletin No. 12, Advertising & Sales Promotion Dept, Solvay Process Div, Allied Chemical & Dye Corp, 61 Broadway, New York 6, N Y* ———Solvay reports that this third edition has been substantially enlarged and now contains 72 pages of text, tables, charts and indexes. New additions or revisions include the adding of new reagents, indicators and standard solutions to the section dealing with these subjects, supplemental methods for determination of metallic impurities and revised methods of tests applied in the analysis of chlorine and hypochlorite bleaches.

THE NIPTROL* PNEUMATIC MANGLE——— *Bulletin No. 54, Rodney Hunt Machine Co, Dept N, Orange, Mass* ——— This booklet explains with schematic diagram how the mangle develops uniform pressure across the full width of the nip, superior extraction, and process flexibility by means of a top roll loading system and a special composition soft roll. The bulletin shows the deflection occurring in ordinary squeeze rolls under load, and how deflection is entirely compensated for in the Niptrol* Pneumatic Mangle.

The advantages of this new mangle in such operations as simple extraction, extraction and starching, resin application, dyeing, and many other finishing operations involving cotton, wool, rayon, synthetic, and mixed fiber fabrics are covered in the bulletin. Specifications, design features, and a discussion of accessory equipment which can be built into the machine are also presented.

* Trade Mark

GENERAL CALENDAR

AMERICAN CHEMICAL SOCIETY
National Chemical Exposition—Oct 12-15, Chicago, Ill.

AMERICAN SOCIETY FOR QUALITY CONTROL
Annual meeting, Textile Div—Jan 27-29, Clemson College School of Textiles.

CHAMBRE SYNDICALE TRAMAGRAS
International Detergent Congress—Aug 30-Sept 5, The Sorbonne, Paris, France.

DELTA KAPPA PHI FRATERNITY
1955 Annual Convention—April 29-30, Lowell, Mass.

DEUTSCHE GESELLSCHAFT FUR CHEMISCHES APPARATEWESEN
Achema XI—May 14-22, 1955, Frankfurt am Main, Germany.

THE FIBER SOCIETY
Fall Meeting—Sept 13-14, McGill University, Montreal, Canada.

Spring Meeting—May 4-5, 1955, Alabama Polytechnic Institute, Auburn, Alabama.

Fall Meeting—Sept 8-9, 1955, Massachusetts Institute of Technology, Cambridge, Mass.

GORDAN RESEARCH CONFERENCES, AAAS

July 12-16, Colby Jr College, New London, N H.

INTERNATIONAL CONGRESS OF INDUSTRIAL CHEMISTRY
27th Congress—Sept 11-19, Brussels, Belgium.

INTERNATIONAL TEXTILE EXHIBITION
2nd Exhibition—June 25-July 10, 1955, Brussels, Belgium.

INTERNATIONAL WOOL TEXTILE RESEARCH CONFERENCE
September, 1955—Sydney, Melbourne, and Geelong, Australia.

NATIONAL INSTITUTE OF DRYCLEANING
4th Educational Conference, Dec 5-10, Silver Spring, Md.

SOUTHERN TEXTILE EXPOSITION
October 4-9 (Textile Hall, Greenville, S C).

TEXTILE TECHNICAL FEDERATION OF CANADA
4th Seminar—Sept 9-11, Queen's Univ, Kingston, Ont.